

A Relook at the Bengal Famine

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The Bengal famine of 1943 is arguably the worst economic disaster of 20th century south Asia. This paper traces the background of the famine and analyses the role of the land market in fuelling food price rise. It appears that in a monetised, already famished, agrarian economy, during situations of subsistence crisis, interlinking of food and land markets has the potential to cause an exponentially high degree of disaster. The role of a universal public distribution system, which carries over food from a surplus to a deficit year, and insulates the food market, thus becomes paramount.

One principal aim of Amartya Sen's *Poverty and Famine* (1981) was to provide a critique of the "food availability decline" (FAD) theory of famine and establish the "food entitlement approach". It is undeniably true – and Sen shows it lucidly – that one cannot have a precise idea of the extent of starvation by simply dividing the food availability of a country by its population. Other factors such as volume of income of the affected people, prices of goods, and loss of livelihood also contribute to the magnitude of destitution and starvation. These factors, taken together, are sought to be encapsulated in the entitlement approach. Sen takes concrete examples of the great Bengal famine of 1943, the Bangladesh famine of 1974, the Ethiopian famine of the early 1970s and finds in these cases that there was only marginal decline in per head food availability. What mattered more were the movements in the food prices or changes of income level in real terms, which pushed down the exchange entitlement of the affected people and shrunk their entitlement set. Sen, in a sense, rescued famines from a climate-population framework and lent them some much needed ingredients of political economy.

This much is easy to understand. It is not very clear why and how the adverse movements in prices occurred which precipitated a fall in food entitlement. Bose (1990) dwelling on the Bengal famine remarks, "(w)hat is intriguing, however, is the scale of the impact of the price-and-market mechanism on entitlement relations". Sen provides some reasons which might have played a part in sparking off exchange rate movements such as unsettling of the local economy in wartime Bengal which led to fear of food shortage (Bengal famine), floods by the Brahmaputra (famine in Bangladesh), eating up of farm and pastoral land by modern farming (Ethiopian famine). But can there be a generic reason why a small decline or the fear of a decline of food supply may spur a rapid rise of food prices? In this paper our effort to find the answer will admittedly be modest as we shall confine our attention to the Bengal famine.

Price Instability

Let us first briefly take stock of what occurred during and before the famine. Reading the various accounts the picture one gets is of extreme price instability. From Rs 13 per 'maund' (37.5 kilograms) of rice in December 1942 it shot up to a range of Rs 80 to Rs 105 in November 1943 [Sen 1981]. The figures for 1943 are non-official, as the government had imposed a price ceiling. Official figures are no less disturbing. Greenough (1982) reports that in Calcutta the price of coarse rice (wholesale) rose from 11 rupees four annas (one anna is one-sixteenth of a rupee) in January 4, 1943 to its peak 34 rupees eight annas in August 23, 1943.¹

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This was accompanied by a sharp fall in real wage for the male agricultural unskilled labourer. In July 1943 it was a mere one-fourth of the December 1941 level. Though numerically the largest group among the famine victims by far [refer to Table 21, Greenough 1982], agricultural labourers, however, did not face the worst of the famine. In many cases their wages were paid in kind, which ensured partial protection from skyrocketing food prices. Destitution was more severe among people engaged in occupations which were removed from food production. If one calculates the proportion of destitute to the aggregate workforce of an occupational category, fisherfolks and transport workers (boatmen and bullock cart drivers) feature at the top of the list.² This observation underlines a simple fact that those whose incomes were not denominated in terms of food faced a shrinking command over food in an inflationary situation, and therefore had to bear the brunt of the famine.³

One question that naturally comes to mind is, if people were facing starvation, what were the options they explored before they were rendered so helpless as to leave their home and hearth and trek to urban centres such as Calcutta⁴ and Dhaka, which were relatively well provided for? Consumption credit market seems to be one obvious answer. Consumption loans, which are as a matter of rule sourced from informal credit market, enable the poor households tide over lean seasons and difficult times. Another source of sustenance which they explored was sale of assets which they owned: land being the most important among them.⁵

It stands to reason therefore that if one has to examine the dynamics of price rise during a famine, one cannot ignore the consumption credit market or the market for land. But in the case of the Bengal famine, one must be advised against treating the entire province as a single homogenous unit. As Bose (1990) notes, in eastern Bengal the structure of the agrarian economy was much different from what was prevalent in western or in the northern and extreme southern Bengal. Agrarian economy of eastern Bengal was much more commercialised. It was a "peasant smallholding society" where jute, a cash crop, dominated along with paddy. The zamindars did not wield much leverage over the peasantry. Indeed they were facing a severe rent crisis in the first half of the 20th century due to a series of tenancy legislations passed in the late 19th century.⁶ Chatterjee (1986) notes that petty jute cultivators were heavily dependent on lean season loans from traders, who also kept the price under tight monopolistic control. Traders, moneylenders and landlord-moneylenders were tied inextricably with the local exchange economy. Monetisation and links with the world capitalist economy were strong. The "peasant smallholding, demesne labour complex" which was more prevalent in western Bengal, and the rest of India with variations, was conspicuously absent in eastern Bengal. In western Bengal jute cultivation was insignificant. The landlords exercised control over the peasantry through landholding or credit operations. Beginning from the late 19th century a process of "depeasantisation" was on in western and south-western Bengal. Small peasants were getting inexorably indebted to the 'jotdars' (big farmers-cum moneylenders),⁷ losing ownership of land and becoming share tenants – usually at 50 per cent share of the harvest – in their own land [Chatterjee 1986]. In the north and extreme south, which had been brought under the

plough fairly recently – in the 19th century – middle peasantry was virtually absent. The jotdars held enormous control over the tenants.⁸ Buchanan Hamilton's account of Dinajpur district (north Bengal) of 1808 speaks of the formidable power enjoyed by the jotdars in credit and grain markets [quoted in Ray and Ray 1975].⁹

Decline in Patronage System

As far as the impact of the famine goes, it was felt most severely in the central and southern districts of eastern Bengal [Figure 4, Greenough 1982]. In the western part of the province, coastal subdivisions of Medinipur district and Diamond Harbour were severely affected. But that region was already in shambles due to the devastating cyclone of 1942. The differing impact of the famine in the east and west may perhaps be explained by the cessation of a system of patronage. The depression of 1930s had significantly unsettled the more commercialised eastern Bengal. If low prices were not bad enough, there was widespread debt snapping, which was in fact prompted by the unremunerative prices. The traditional support system of patron-client was in turmoil. Bose (1990) remarks, "[t]he peasant's mahajan (money-lender) had decisively withdrawn from the processes of reproduction of the agrarian economy of Bengal". Virtually no investments were forthcoming during the depression decade as funds started to flow out of the economy because: (a) prices were depressed; (b) the colonial government had to siphon out funds from the colony to the troubled metropolis. As pound sterling and therefore rupee were untethered from gold standard, gold prices started to climb high (trouble in the financial market might also have been a contributing factor). This resulted in a large outpouring of gold from the countryside. This development would weaken the peasantry in the long run as their capacity to borrow became impaired. In western Bengal, credits denominated in terms of grain, which were lent out by the landlords to the peasants strengthened the dependence of the latter on the former.¹⁰

Like Bose, Greenough (1982) also notes the decline in the patronage system in Bengal right from the 19th century. The permanent settlement (1793) might have had the noble intentions of engendering the English-style landlord-tenant-agricultural worker complex in Indian conditions. Eventually, however, imposition of the model of maximisation and self-interest on a society of different social mores led to unintended consequences.¹¹ In the permanent settlement arrangement benefits of a rise in land productivity accrued mostly to the zamindar. It was therefore hoped that he would take the necessary steps to improve the fertility of land through productive investments. What many risk-averse landlords actually did was to sell off the right to collect rents in exchange for a fixed return. The sub-proprietors, or the buyers of such rights, in turn passed off the risk by selling the rights to another layer of intermediaries in lieu of a fixed return. Very soon layers and layers of intermediaries were spawned. A remarkably active market for rental rights had surfaced by the 1830s. These intermediaries had no reason to show much interest in raising the productivity of land as the share that would accrue to them of the rise in output would have been minuscule. The

burden of the huge and intricate architecture of intermediaries of course rested on the actual cultivators placed at the bottom of the pyramid. This had some consequences of major import. One, the traditional “zamindari paternalism” waned as the zamindar became a distant entity for the cultivators. Indeed, a large number of former zamindars had lost their zamindaris as the impersonal legal and fiscal systems imposed by the British proved to be too ruthless and alien for them. Two, surplus from land went largely to support the intermediaries, rather than to raise the long-run productivity of land [Bhaduri 1976]. Between 1891 and 1947, rice production in Bengal declined at 0.3 per cent to 0.77 per cent per annum according to different estimates. Population was rising and the diet of an average Bengali as a result was much poorer in the 1930s than it was in the 1860s. Thus there was a continuous decline of the rural economy and people’s living conditions during the decades preceding 1943. The famine, in a way, was the culmination of a moribund agrarian system.¹²

In sum, though borrowing from the moneylender or landlord would have been an obvious way to deal with falling food entitlement, the rural poor in eastern Bengal scarcely had that option. To make things worse, eastern Bengal was already in a crisis because of (a) its dependence on the jute economy which had failed its peasants; and (b) its high degree of monetisation. Rising food price in the early months therefore led to distress sale of assets by the peasants. The first choice for them would surely have been to mortgage, not to sell, their source of livelihood. The Indian Statistical Institute (ISI) sample survey reveals that, in 1943 about 5,63,000 peasant families had mortgaged their land. It was also found that three out of four such lands thus transferred could never be reclaimed by the original owners. Therefore selling off the land altogether was an almost equally painful but necessary option. Between April 1943 and April 1944 about 9,25,000 families sold their lands. They account for 14 per cent of landowning families of the entire province. In terms of percentage of total paddy land of Bengal, the sold land was 3 per cent. The difference between 14 per cent and 3 per cent suggests that it was the bottom-most section of the peasantry which was the hardest hit. Indeed, as much as 36 per cent of rural families were landless and hence did not even have the option of selling land. Another 40.5 per cent had land below two acres. Two acres was the critical level for supporting an average family of five members. It was this category of “below two acres” which was selling their land at throwaway prices as their dependence on market for procurement of food was high. Greenough (1982) reports in that Contai town, Medinipur, 150 sale deeds were being executed daily. An average sale deed consisted of land size ranging from merely one-third to two-thirds of an acre, with the price actually accruing to the buyer being only a fraction of what was stated in the deed. In 1944, the jute economy recovered. But the marginal peasants who had already lost their land were now left hapless spectators.

Land Market and Food Prices

A suddenly active land market and rising food prices are therefore not matters of coincidence. A high food price, which may have been started off by shortfall of food supply (or the expectation of it), forces the bottom sections of the rural poor to seek

consumption loans. In the absence of this, or when this option had exhausted itself, assets are disposed of. Land transaction rises and land price declines. But this act itself may trigger off further rounds of adjustments in both food and land markets. As the proceeds of land sale enter the food market to chase increasing elusive food, it fuels further rise of food prices. As described earlier, rising food prices will translate into shrinking purchasing power for the poor. It would push up the volume of distress sale, as another stratum of the rural poor would be experiencing fall of exchange entitlement to below-subsistence levels. The mutually reinforcing play of food market and land market will continue and a new position of rest may be reached only under certain conditions. At the new equilibrium food price, land transactions will have gone up by large amounts whereas land price would have plummeted due to the above-mentioned dynamics.

The end result is not difficult to discern. Since the rest of the economy is capable of protecting their food entitlement in the face of rising prices, the rural poor will be left with lesser food to consume compared to the situation when shortfall of food supply had not taken place. For the class as a whole, selling off land and other assets did nothing to expand their exchange entitlement. Moreover, they are now bereft of productive assets. The landless will surely be the hardest hit victims of the whole process. They were not behind the food price rise and are left in a deeper misery by virtue of it. Comparing the final equilibrium with the initial position, it appears that if the poor knew what they would end up with, they would not have sold off their assets. But surely this requires a high degree of coordination among the rural poor, which can hardly be expected in a large agrarian economy with millions of desperate families fighting their isolated battles as the tide of food prices inundates them. In other words, they are stuck in a prisoner’s dilemma like situation. The Pareto superior outcome of not selling off the assets and to stay put is not an equilibrium.¹³

A Model: It may be analytically rewarding to represent the abovementioned mechanism in terms of a rudimentary mathematical model. Let us suppose F denote aggregate food supply in our model economy. We shall assume, to keep things simple, that it is a parameter and independent of other variables of the model. To keep focus on our principal contention, we shall not consider such admittedly vital matters as role of price expectations and hoarding of food stock by the suppliers. Variable A denotes that part of demand for food which is indexed to food prices. In other words, there are some classes of people who can afford to keep their real consumption of food unchanged through proportional higher spending, even as food price rises. These people may be the rich of both urban and rural areas. They may be the urban workers who are organised and hence are in a position to defend their real wage.¹⁴ $B(p)$ denotes demand for food of the peasant families with less than two acres of land, and the landless poor, which is supported by of their income. Variable p here denotes food price. We shall assume $B(p)$ is a differentiable function of p , with negative first derivative ($B_p < 0$, implying as food price rises purchasing power of the rural poor falls) and a constant second derivative, for simplicity. Regarding the land market, variable $L^p(q)$

will stand for demand for land, which is a function of land price q . $L^D(q)$ is a differentiable function of q with negative first derivative ($L^D_q < 0$, implying as land price rises the buyers may demand less of it) and a constant second derivative. Supply of land for sale is given by $L^S(p, q)$. $L^S(p, q)$ is differentiable with respect to both food price, p and land price, q . The first partial derivatives are positive ($L^S_p > 0$, as price of food rises the rural poor face a declining exchange entitlement and hence are compelled to sell their land; $L^S_q > 0$, as price of land rises its supply also rises), with constant second partial derivatives. To keep things tractable let us assume that all of sale proceeds for land are spent on food purchase. Variables p and q are the exchange rate of food and land with money, they are measured in monetary units. Aggregate variables, namely F, A, B, L^D and L^S , are measured in terms of food.

Having thus defined the principal variables it is possible to write the equilibrium conditions in the two markets. For the food market it is,

$$F = A + B(p) + L^S(p, q) \quad (1)$$

On the left hand side we have the aggregate food supply, F . On the right hand side we have the aggregate demand for food. $A + B(p)$ denotes ordinary demand for food emanating from the rural and urban rich and poor financed by their income. The rural poor may get forced to part with their asset, land, and the proceeds of the distress sale are used to buy food. $L^S(p, q)$ denotes this component. Therefore demand for food in aggregate is, $A + B(p) + L^S(p, q)$.

The land market equilibrium condition is given by,

$$L^S(p, q) = L^D(q) \quad (2)$$

This is the straightforward equality of supply of land with the demand for it.

Normally food price would get determined in the food market and land price would get determined in the land market. Here, however, we can see p and q enter both the equilibrium conditions. This is at the heart of instability of this system of equations. From a equilibrium situation if some perturbation occurs (may be due to a fall in F) then the markets try to reach a new set of equilibrium values. But as one market tries to get to equilibrium through appropriate change in its adjusting variable (p or q) it leaves the other market in disarray. We have the conditions of local asymptotic stability in the appendix. It also contains the changes in food prices, land price, land transactions which occur due to the fall in food supply.

The condition for stability is L^S_p should be sufficiently small in magnitude. This appeals to intuition. L^S_p measures the change in supply for land with respect to food price change. It is a link which connects the two markets. As food market tends to reach its demand-supply equating state of rest through change in food prices, the change in food price itself destabilises the land market, which has been in equilibrium so far. L^S_p is the rise in distress sale of land as food price rises. If the magnitude L^S_p is small enough, then adjustments in food market are not capable of creating much instability in the land market. Acting in relative isolation, each market would reach a state of rest. Stability, for this reason, demands that L^S_p be small in magnitude. Change of q affects the food market too. But that effect is a stabilising one. A fall in F leads to excess demand in food market. Rise

in p attempts to restore equilibrium. But this generates additional distress sale in the land market, proceeds of which enter the food market in order to create more instability there. The fall in land price reduces the volume of sale proceeds, thus softening the impact of the rise of distress sales.

Conclusion

The purpose of this exercise was to underline the role that land market may play in a condition of starvation and declining entitlement. It also brings home the paradoxical result that in famine conditions poor people may be making matters worse by selling off their assets at increasing unfavourable terms (it may be remembered that the volume of money which entered the food market by sale or mortgage of land was substantial; nearly 3 per cent and 1.8 per cent of paddy land of the entire province was sold off and mortgaged, surely most of the proceeds seeped into food market). But as we have noted, starving people have little choice but to act as atomistic individuals and get condemned to a Pareto inferior state. This, of course, leaves the land buyers much better off. The difference in famine experience of eastern Bengal and the rest of the province supports our hypothesis. In western, northern and extreme south Bengal, the peasantry was relatively powerless against the big landlord. The agrarian economy was less monetised. Ownership of land was mostly with the landlord. In times of crisis, the landlord provided peasants with grain loans. This may have been against onerous terms but it, to an extent, helped them survive the famine. In the east, the peasantry was more independent and market-oriented. This contributed to their misery as there were few to provide loans – let alone grain loans – in the aftermath of the depression of the 1930s. Furthermore, to protect their food entitlement they sold off land – which they were capable of doing unlike their western brethren – but this had the unintended consequence of accelerating the food price and impoverishing them further.

A few qualifications are in order. One, we do not claim that the mechanism we have detailed here is the sole reason behind the tremendous rise in food prices. As many have argued [Bailey 1945, for example] factors such as hoarding and speculation, unwilling sellers, shoddy administrative response, wartime disruptions, etc, were important. Our modest aim was to highlight the role an active land market played in price dynamics. Two, it is admitted that the price rise may not have been the sole reason behind famine deaths. A number of researchers, including Dyson (1991), have pointed out that, spread of famine diseases in causing the deaths – malaria being the most relevant in the south Asian context – have to be contextualised. But surely, as one faces economic hardship due to loss of entitlement one's diet deteriorates, immunity declines and susceptibility to diseases rises. Spread of disease also rises due to migrations which had been prompted by loss of livelihood. The economics of famine which we have attempted to examine here does not preclude the role of famine diseases. It sets the background for them.

Are there any lessons for the policy framers? The picture of instability painted here stems from the interlinking of the two markets. Hence one way to avoid runaway food price could be to

insulate the markets, such that the poor do not resort to distress sale in a situation of rising food prices. For this, expanding the reach of the public distribution system (PDS) may be an option.¹⁵ If prices in PDS shops remain constant even as prices shoot up in the open market, poor people would turn to these shops rather than disposing off their productive assets. It may be noted that it is not necessary that the price in PDS shops be lower than the open market price of normal times. The only requirement is, PDS price is less than the famine price of open market and that there is sufficient

food in the reserves to meet the demand. A natural question may arise: in the middle of a famine where will the PDS get the food from? The solution may lie in maintaining a long run stock of food. In years of abundant harvest higher procurement would ensure remunerative prices for farmers who have surplus food to sell. During scarcity years, the stock will be helpful in avoiding a famine. In short, this is an instrument of consumption-smoothing of the macroeconomy.¹⁶ We may add, it may also act as buffer between the classes of surplus producing farmers and famine victims.

NOTES

- 1 Also refer to Figure 6 of Dyson (1991).
- 2 Refer to the index of victimisation of different occupation groups estimated by the Indian Statistical Institute under Mahalanobis based on a survey conducted in May 1944; this is reproduced in Greenough (1982).
- 3 Contemporary Bengali literature bears similar testimony. Bibhutibhusan Bandyopadhyay's well known *Ashani-Sanket* [1991(1943-45)] – later turned into a film by Satyajit Ray – had many of the famine victims from the non-cultivating occupations. Nabeen Parui, an impoverished fisherman, laments, “[p]easants have rice in their homes, we don’t. Our misery is the worst...Earlier they would lend us rice or paddy. These days they don’t.”
- 4 Refer to Raychaudhuri (2007) for a first-hand account of Calcutta by a historian.
- 5 Bhaduri (1977) explores reasons why it is not the formal, organised, credit market which comes to the rescue. To the present day consumption loans remain significant to the poor, NSSO report (1998) states that for the rural poor (owning assets to the tune of less than Rs 10,000) 60 per cent of the loans were for consumption purposes in the year 1991. The report further points out that the “non-cultivators” (agriculture labourers, artisans, etc, of the rural areas are included – they are the poorest with land ownership of less than .002 hectares per head) are more dependent on the non-institutional loans than the institutional loans compared to the “cultivators”. However, data of consumption loans are notoriously difficult to obtain. This is one reason why our focus in this paper will be confined to land market. Ravallion (1997) notes the absence of credit market in famine literature. He also cites the sale of livestock during African famines, which is similar to land sale during Bengal famine.
- 6 Especially the Rent Act of 1859 and the Tenancy Act of 1885. Chatterjee (1986) proposes that curtailment of the zamindars’ right of property (which itself was rather ambiguous given the Mughal administrative practice of endowing zamindars and taluqdars the right to collect revenue, not to own land; a point made by Ray and Ray, 1975) had the aim of protecting petty peasant production, which to a limited extent responded to market forces. Furthermore, Pabna revolt (1874) and other disturbances demonstrated that “high landlordism” would be an unwise strategy for governance. Consequently the zamindars did not receive much succour from the colonial administration when faced with the rent crisis.
- 7 Refer to Ray and Ray (1975) for a study on the evolution of the jotdars, a category of big farmers cum landlords.
- 8 It is noteworthy that these areas became breeding grounds of the Tebhaga movement during the mid-1940s.
- 9 This brings to mind the unequal power balance which the peasantry was subjected to by their lords in the recently colonised Eastern Europe during the late middle age [Brenner 1978].

- 10 Ravallion (1997) notes, “[p]easants with enough land to be net producers of food will gain from higher food prices, but other peasants and landless labourers will probably lose, though even among the latter group, some will be protected by longer-term contracts”. Peasants in western Bengal belonged to the group which was poor but nevertheless enjoyed long-term contracts.
- 11 Ray and Ray (1975) provide a nuanced analysis. Chatterjee (1986) quotes Marx (1971), “[the Permanent Settlement became] a caricature of large-scale English landed estates”, one of “a string of futile and really absurd (in practice infamous) economic experiments [which the British carried out in India]”.
- 12 The ISI survey found in May 1944 that of the total number of destitute (1.076 million) as much as two-thirds were in that state before January 1943, that is, before the famine even started.
- 13 Ravallion (1997), in a different context, comments, “[t]his point also illustrates the pervasive, but often neglected, externalities involved in famines. In various ways, individually rational responses to the threat of starvation (of which migration is one example) can aggregate into an enhancement of that threat.”
- 14 Sen (1981) quoting from the Famine Inquiry Commission (1945) notes that the official policy was “the maintenance of essential food supplies to the industrial areas of Calcutta must be ranked on a very high priority among their [the government’s] war time obligations” and that the government

was prepared to do “all in their power to create conditions under which essential supplies may be obtainable in adequate quantities and at reasonable prices”. Consequently some 8,00,000 employees of the industrial concerns in and around the city were covered by a network of fair price shops regularly supplied by the government. It is not surprising that 60 per cent of the distress sale land went to people who were not involved in cultivation and did not live in the villages [Greenough 1982].

15 Partial cover may make things worse for those who are not covered. The covered population is given a fixed entitlement. This would mean that for the uncovered group less is available per head compared to the situation wherein no one was covered. Provision of a fixed ration to the urban working class during the famine may have had a detrimental effect on the entitlement of the rural poor.

16 Empirical concavity of individual survival rate with respect to food consumption leads Ravallion (1997) to conclude that stabilising individual consumption over time may be optimal. This is what PDS seeks to achieve. Ravallion also finds that unstable food prices contribute significantly to famines. This also is sought to be mitigated by PDS.

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Appendix

Conditions for local asymptotic stability and magnitudes of changes in food, land prices, land transactions due to change in food supply: The equilibrium conditions in food and land markets are given by,

$$F = A + B(p) + L^s(p, q) \tag{1}$$

$$L^s(p, q) = L^D(q) \tag{2}$$

Let α and β (both positive in value) denote the speeds of adjustment of the adjusting variables, p and q , in food market and land market respectively. So we have,

$$\frac{dp}{dt} = \alpha [A+B(p) + L^s(p, q) - F] \tag{3}$$

$$\frac{dq}{dt} = \beta [L^D(q) - L^s(p, q)] \tag{4}$$

The Jacobian matrix is given by,

$$J = \begin{bmatrix} [\alpha(B_p + L^s_p)] & \alpha L^s_q \\ -\beta L^s_p & \beta(L^D_q - L^s_q) \end{bmatrix}$$

Starting from a equilibrium state, if there is a shortfall of food supply a perturbation is created

in the system. Whether it is capable of reaching a new equilibrium is dependent upon the following two conditions. (a) Trace of the matrix, $T = \alpha(B_p + L^s_p) + \beta(L^D_q - L^s_q)$, is negative in sign. Because αL^s_p is positive this condition will not be readily satisfied. (b) Value of the determinant of J is positive in sign. Here it is,

$|J| = \alpha\beta [(B_p + L^s_p)(L^D_q - L^s_q) + L^s_q L^s_p]$. Let $D = (B_p + L^s_p)(L^D_q - L^s_q) + L^s_q L^s_p$. We know $B_p(L^D_q - L^s_q), L^s_q L^s_p > 0$. However, the term, $L^s_p(L^D_q - L^s_q)$ is negative. Hence D is not unambiguously positive. In case of both the conditions we observe that it is the term L^s_p which is responsible for creating ambiguity. In the absence of this term, or if it is small enough, conditions for stability would be satisfied. If the conditions are satisfied then the changes in p, q and L (land transactions) with respect to changes F are given by,

$$\frac{dp}{dF} = \frac{(L^D_q - L^s_q)}{D}$$

$$\frac{dq}{dF} = \frac{L^s_p}{D}$$

$$\frac{dL}{dF} = \frac{L^s_p L^D_q}{D}$$

The first and last of these are negative, implying that food price and land transaction rise as food supply declines. The second expression is positive – land price sinks as food supply falls.