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Macroeconomics and Famine

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Abstract

The aim of the paper is to shift the focus of famine analysis away from food supply towards the macroeconomic determinants of food entitlement--i.e., to the ability of individuals to purchase food. Towards this end, we develop a model to demonstrate how loose monetary and fiscal policies may give rise to famine even when there is no change in per capita food output. We illustrate our findings with a description of the 1974 Bangladesh famine.

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Summary

In an important contribution to the theory of famines, Sen (1981) has argued that the great famines of the twentieth century were not caused by a decline in per capita food output but rather by a decline in individuals' ability to purchase food. This paper utilizes such an "entitlements approach" to develop a model that explains how loose monetary and fiscal policies may cause famines even when there is no decline in food output. The basic idea is that expansionary macroeconomic policies can lead to sharp increases in the relative price of food--which reduces people's ability to purchase food both directly through the standard price effect and indirectly by generating greater unemployment.

The typical underdeveloped economy susceptible to famines is modelled using efficiency wage theory, an analytical device that yields chronic unemployment. The chronically unemployed form a group of destitutes that survive mainly by begging, scavenging, or performing menial tasks. They obviously have the smallest food entitlement and are most vulnerable to any increase in the relative price of food. Further, an increase in the relative price of food is shown to lead to greater unemployment arising from the contraction of the nonfood sector--which only serves to aggravate the problem.

The transmission mechanism from macroeconomic policy to higher relative food prices, and thence to famine, is now easily traced. For example, in a situation where available hedges against inflation are limited, higher monetary growth results in a portfolio shift away from real money balances toward the holding of physical assets such as foodgrains--a process that results in a sharp, but temporary, increase in the relative price of food (because food consumption must be squeezed in order to make room for greater stock holding). If the ensuing loss in food entitlement is sufficiently severe, and correspondingly prolonged, the result is famine.

This framework is applied to reexamine the events leading up to the Bangladesh famine of 1974. In contrast to the view that the famine was caused by floods, the paper argues that an explanation along the lines sketched above is, if not conclusive, at least plausible.

The main practical point emerging from our model is that an effective response to famine requires macroeconomic policies that reduce the relative price of food. If the famine has been preceded by rapid monetary expansion, the appropriate policy response may require some reduction in monetary growth rates. The best government intervention is the direct provision of food from buffer stocks. Alternatively, if foreign grants or concessional foreign borrowing are available, imported food could be distributed to the affected population. In contrast, fiscal operations to procure foodgrains domestically when a famine is already in place tend to drive up the relative price of food and exacerbate the problem of inadequate food entitlement.

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I. Introduction

Of all human tragedies, famine is surely the one that falls most obviously in the domain of economics. However, until very recently, economics did not have much to offer beyond the man on the street explanation that famines occur "because there isn't enough food to go around." To be sure, a number of economists did progress beyond the simple drought and locusts view of famines--for example, to the analysis of faulty agricultural pricing policies--but the focus remained on factors that reduce the physical supply of food.

A.K. Sen's (1981) book Poverty and Famines has done much to challenge this view. There are two essential ingredients to his argument. First, there is the empirical observation that per capita food availability did not decline during five major famines in the 20th century. Second, Sen argues that what did decline for a large section of the population was food entitlement, the purchasing power of income and wealth over food. In terms of the familiar diagrammatics of microeconomics, a famine is associated with an increase in the relative price of food--not necessarily due to a decline in food supply--which leaves the minimum food basket outside the reach of some consumers' "budget line."

Once the role of effective demand for food is brought to the foreground, one can take the initial steps away from the view that macroeconomics and famine are unrelated subjects of inquiry. Specifically, it is argued that macroeconomic policy is a fundamental determinant of the relative price of food in the short run--the only time horizon that matters for the analysis of famines--and thus may lead to or exacerbate famines. We demonstrate, for example, that an increase in monetary growth does not merely cause across the board increases in all prices but instead leads to a temporary rise in the relative price of food. Such short-run non-neutrality of money is hardly news, but how precisely does this lower food entitlement, and what determines who is to go hungry? These are the questions addressed in this paper in the context of a variety of macroeconomic policies. We illustrate our findings with a description of the Bangladesh famine of 1974.

II. Entitlement, Employment, and Hunger

By the term entitlement we refer to an individual's command over commodities through exchange of assets, both physical and financial, and labor power. Thus a person's food entitlement refers to his ability to exchange assets and labor power--and the income derived from them--for food. In less developed parts of the world, where the distribution of wealth is highly skewed and the social "safety net" almost nonexistent, the food entitlement of the vast majority depends on the sale of labor.

However, the sale of labor power--i.e., employment--is not a straightforward matter; involuntary unemployment is a pervasive fact of life in many parts of the world. The most common explanations for such unemployment involve a variety of microeconomic or social factors that make workers unwilling or slow to accept cuts in nominal wages. In the context of a less developed economy, this could pass as a plausible, if not entirely convincing, explanation of urban unemployment. But unemployment and underemployment are often widespread in rural areas too, and one might ask what prevents an unemployed laborer, especially a hungry one, from offering to work for slightly less than the going wage? According to one view--one we would subscribe to--the answer to this question is: nothing. Involuntary unemployment, and hence a greatly diminished entitlement to food, is not caused by the unwillingness of workers to accept lower wages but rather by the unwillingness of employers to hire them at lower wages. This last point is the basic message of efficiency wage models of the labor market that have been attracting greater attention in recent years. 1/

Efficiency wage models begin by distinguishing between labor time and labor effort, emphasizing that it is the latter which is an input in the production function. Thus the "effort" with which one works any given hour is what determines output. While conventional microeconomics regards effort as a constant, efficiency wage theory, as applied to underdeveloped economies, recognizes that it varies with nutrition: an undernourished worker simply lacks the physical ability and the psychological motivation that a well-nourished worker commands. 2/ But if a worker's food entitlement and nutrition are derived mainly from wage income, it follows that effort, and hence output, varies with the real wage that is paid to labor. Firms must then trade off the benefits of lower real wages with the cost of reduced effort on the part of workers. The next section analyzes this problem, a procedure that yields a unique real wage in terms of food--the efficiency wage--that a profit maximizing firm will always choose. For each level of demand, the firm employs a given number of workers and pays them the efficiency wage. The remainder of the labor force is not only unemployed but also unemployable, even if they offer to work for less than the going wage, because the detrimental effects on worker effort outweigh the gains from paying everyone less than the efficiency wage.

In normal times, a society may be able to carry forward a considerable stock of such involuntarily unemployed workers who subsist at a low level of nutrition by begging, scavenging or, at best, by performing menial tasks for the well to do. However, as demonstrated below, macroeconomic policies can result in a sharp increase in the relative

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1/ Akerlof and Yellen (1986) and Dasgupta and Ray (1986, 1987) provide an excellent introduction to the literature.

2/ For empirical studies documenting these linkages, see Behrman, Deolalikar, and Wolfe (1988) and references cited in that paper.

price of food, thus reducing the already meager entitlement of those subsisting at the fringes. In addition, a higher relative price of food is shown to lead to greater unemployment arising from the contraction of the nonfood sector--which only aggravates the problem of inadequate food entitlement by creating a new class of "derived destitutes." The result is increased hunger and, if the deterioration in food entitlement is sufficiently severe, famine.

The analytical role of efficiency wage models thus consists of not only explaining the existence of chronic destitutes--the segment of society most vulnerable to a decline in food entitlement--but also in explaining additional unemployment resulting from changes in relative prices. The following sections are devoted to developing such a model and tracing the transmission mechanism from macroeconomic policies to the relative price of food, to employment and food entitlement, and thence to hunger and famine.

III. A Simple Macro Model

In order to capture the essential points, we begin with the analysis of a closed economy that produces two goods, food (which is storable) and a composite called nonfood (which is not). The storability of foodgrains is a key assumption that allows one to highlight the determination of food prices in asset markets rather than by flow demand and supply. Each good is produced using labor, which is mobile, and a sector-specific factor in fixed supply: land in the case of food, and capital in the nonfood sector. As the sector-specific inputs are not explicitly considered in this model, accumulated wealth may only be held in the form of money or else foodgrain.

The production side of the economy is described by

$$e\left(\frac{w}{p_f}\right) = 0 \qquad 0 < \frac{w}{p_f} < \omega_1$$

$$> 0 \qquad \frac{w}{p_f} > \omega_1 \qquad (1)$$

$$e'(\,) > 0, \quad e''(\,) < 0 \qquad \text{for all } \frac{w}{p_f} > \omega_1$$

$$Q_f = \left[e\left(\frac{w}{p_f}\right) \cdot L_f\right]^{\alpha} \qquad \alpha < 1 \qquad (2a)$$

$$Q_{nf} = \left[e\left(\frac{w}{p_f}\right) \cdot L_{nf}\right]^{\beta} \qquad \beta < 1 \qquad (2b)$$

Equation (1) defines effort as a function of the real wage, with food being the relevant deflator for wages on account of our emphasis on

nutrition. This functional specification, graphed in Fig. 1, postulates a threshold level of consumption ω_1, the resting metabolic rate, before positive work effort is forthcoming. One could identify ω_1 with the "starvation point," even though the latter will generally lie below ω_1. Equations (2a) and (2b) are the production functions where L_f and L_{nf} are the labor times applied to food and nonfood and where, to economize on the notation, the fixed factor in each sector has been suppressed.

Consider first the firm's profit maximization problem. It must decide the number of workers to employ--each of whom works a fixed number of hours per day--as well as the real wage offered to any worker. It is the coexistence of the latter problem that distinguishes efficiency wage models from the standard neoclassical one.

Making nonfood the numeraire and letting $R = p_f/p_{nf}$, the profit maximization problem in the nonfood sector is

$$\underset{\{L_{nf},\ w/p_f\}}{\text{Max}}\ p_{nf} Q_{nf} - wL_{nf} \qquad \text{subject to (1) and (2b)}$$

for which the first order conditions are:

$$L_{nf} = \frac{1}{e(\omega)} \left[\frac{\beta e'(\omega)}{R}\right]^{1/(1-\beta)} \tag{3}$$

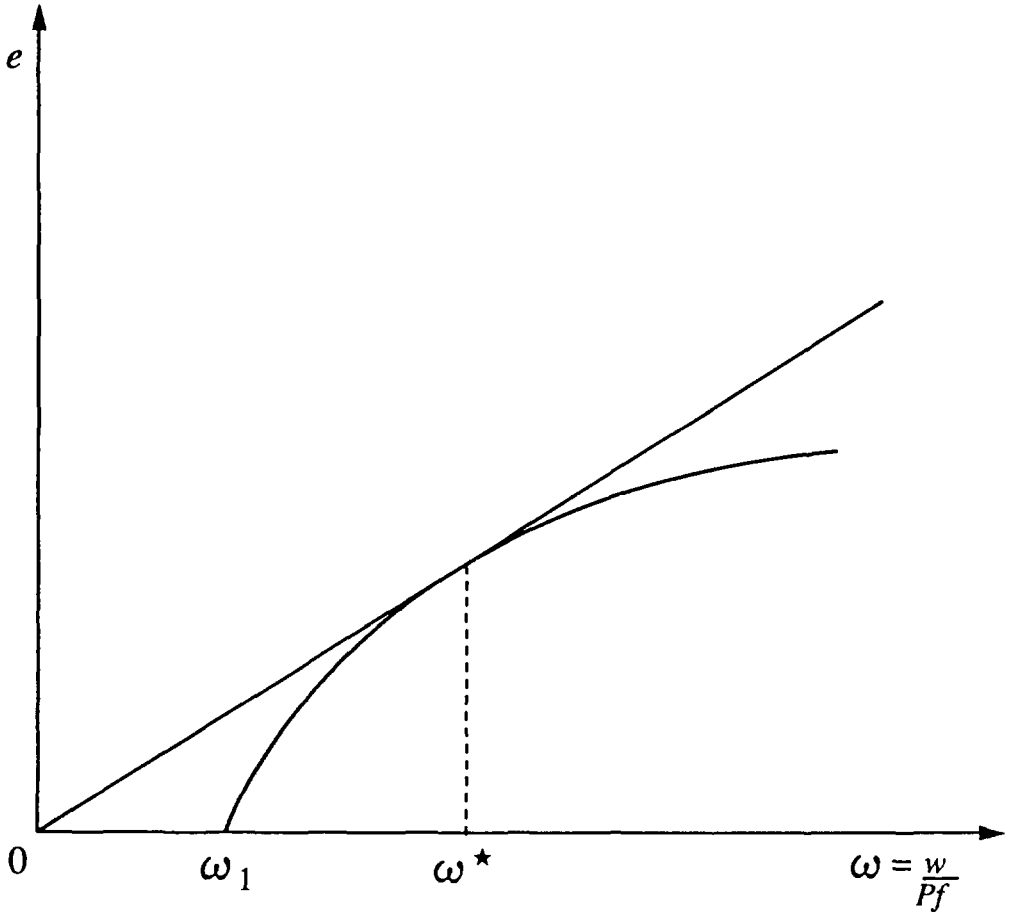
$$L_{nf} = \left[\frac{\beta e^{\beta}(\omega)}{R\omega}\right]^{1/(1-\beta)} \tag{4}$$

where $\omega = w/p_f$. Using (3) and (4)

$$\frac{\omega^* e'(\omega^*)}{e(\omega^*)} = 1 \tag{5}$$

Equation (5) yields the optimal ω^*--the efficiency wage--where the elasticity of effort is unity. In the current setup, employers do not maximize profits by seeking to pay the lowest possible wage per hour of work but rather by paying the lowest possible wage per unit of efficiency. Turning Fig. 1 on its side, it is clear that the lowest

Figure 1
Determination of the Efficiency Wage



ω/e occurs at the tangent to the efficiency curve where average and marginal efficiency are equal. 3/

Substituting ω^* and L_{nf} in the production function,

$$Q_{nf} = \left[\frac{\beta e'(\omega^*)}{R}\right]^{\beta/(1-\beta)} \tag{6}$$

Output of nonfood varies inversely with R, the relative price of food in terms of nonfood. This is because the firm pays a fixed wage in terms of food even as the unit value of its output declines in terms of food, thus forcing it to cut back production.

Similarly, maximization of profits in the food sector yields

$$L_f = \frac{1}{e(\omega^*)} \left[\alpha e'(\omega^*)\right]^{1/(1-\alpha)} \tag{7}$$

$$Q_f = \left[\alpha e'(\omega^*)\right]^{\alpha/(1-\alpha)} \tag{8}$$

Note that output of food is constant regardless of the relative price of food. The reason is that while a higher R raises the value marginal product of labor, this is exactly offset by a commensurate increase in nominal wages required to maintain the efficiency wage.

Suppose now that there are exactly $\bar{L}$ workers in the economy all of whom have a very low reservation wage (say, in the vicinity of ω_1) and hence supply labor inelastically. The number of workers actually offered employment is given by adding L_f and L_{nf} derived from (4) and (7). By equating demand for labor with the total available supply,

$$L_{nf}(R) + L_f = \bar{L} \tag{9}$$

one can solve for the critical R_c which yields full employment. However, there is nothing in the model that ensures a value of R consistent with full employment. Whenever $R < R_c$, labor is in short supply, and wages get bid up in excess of the efficiency wage. This is the world inhabited by the standard neoclassical model. On the other

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3/ An interesting extension of the model, which would not alter any of our results, would be to postulate distinct effort functions, and so derive two efficiency wages. Such a specification would thus yield an irreducible real wage differential between the two sectors a la Harris-Todaro (1970), but one based on efficiency wage theory rather than on the dynamics of rural-urban migration.

hand for $R > R_c$, there is chronic excess supply of labor. 4/ Our model thus yields a precise definition of the "labor surplus economy" studied in development economics and, as this is the case that interests us, we restrict our attention to it in the rest of the paper. 5/

Fig. 2 presents a graphical representation of the supply side of the economy. The vertical axes both measure R, starting at R_c, while the length of the horizontal axis corresponds to the total available labor $\bar{L}$. Moving from O_f rightwards, one measures employment in the food sector; moving leftwards from O_{nf}, one measures employment in the nonfood sector. The fact that the level of employment in the food sector is independent of R is represented by a vertical line at $\bar{L}_f$. Further, we know that as R rises above R_c, demand for labor in nonfood declines--hence the upward sloping curve L_{nf}. The level of unemployment corresponding to any given R is the horizontal difference between these two curves; only at R_c is that difference zero.

A standard way of depicting the demand side of the economy is to have demand for each good depend on its relative price and on real wealth (see, e.g., Calvo and Rodriguez (1977)). However, in our model, this creates a problem insofar as a higher R raises demand for nonfood via the standard price effect but may reasonably be expected to lower demand due to greater unemployment. It is easy enough to write down the elasticity condition that would eliminate this ambiguity and yield demand functions with the usual signs.

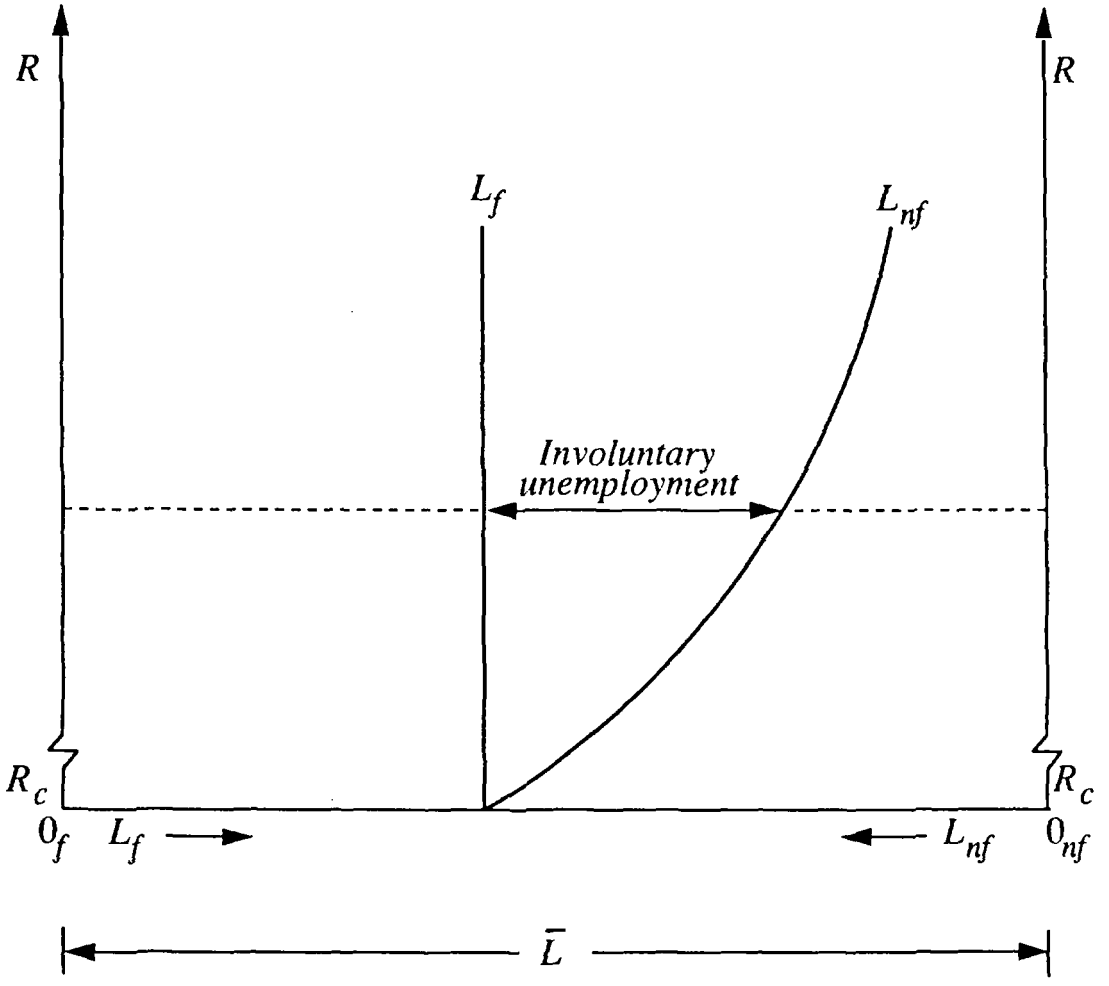
However, rather than follow this sterile procedure, we choose a more colorful, but analytically equivalent, formulation in the tradition of classical political economy. Consider then a Ricardian division of society in terms of the three factors of production i.e. landlords, capitalists and workers. 6/ This allows the model to correspond to widely held perceptions about the class basis of famine, for example, the immunity of privileged classes from hunger, and the acute conflict of interest in times of crisis.

4/ Market forces can do nothing to alleviate steady state unemployment in this model, but technological progress can. This is evident from the fact that L_f and L_{nf} are both positive functions of α and β.

5/ In the labor tight economy, everyone is employed and receives a wage in excess of the efficiency wage. As a result, there is no question of famine in this region of R. Of course, it is possible to be near the borderline, and lurch from one region to the next. However, no new analytical insight is gained from considering this case.

6/ "Capitalist" is something of a misnomer for the owners of the hidden factor of production in the nonfood sector because they fail to perform, in this short run model, what is generally regarded as their principal function: the accumulation of capital.

Figure 2
Equilibrium in the Labor Market



In order to strip the model of its ambiguities, and so best illustrate the points we wish to make, we follow Findlay (1974) in assuming that landlords consume only nonfood (perhaps along with a small and constant amount of food) and that workers and capitalists consume only food. Wealth (money and food stocks) may be distributed across all three classes, but it is most realistic to imagine that it is concentrated (say, equally) in the hands of landlords and capitalists. Consumption of each good will then depend on the distribution of income and the level of real wealth. However, as demonstrated below, the distribution of income is itself a function of R, so we are left with a formulation that is analytically equivalent to the standard one: demand for each good depends on R and on real wealth.

Before coming to this, however, we introduce a government that spends g_f and g_{nf} on each good and finances its activities by levying direct taxes and by money creation. The government's expenditure on food may be thought of as a thinly spread nutrition program for the chronically unemployed and underemployed. The government budget constraint can be written as

$$g_{nf} + Rg_f - \tau = \frac{\dot{M}}{P_{nf}} = \mu m \tag{10}$$

where m denotes real money balances in terms of nonfood, τ is real taxes (also measured in terms of nonfood), and μ is the rate of growth of nominal money.

The private sector's demand for nonfood depends entirely on the earnings of the landlords. Their profits are equal to $R(1-\alpha)\bar{Q}_f$. 7/ Thus we may write the demand for nonfood as

$$C_{nf}\left[R(1-\alpha)\bar{Q}_f - \frac{1}{2}(\tau - \pi_{nf}m + \dot{R}^e F),\ \frac{m+RF}{2}\right] + g_{nf} \qquad C^1_{nf}(),\ C^2_{nf}() > 0 \tag{11}$$

where the superscripts are the partial derivatives with respect to real disposable income and wealth. Note that disposable income is profits less direct taxes ($\tau/2$) less the expected inflation tax ($\pi_{nf}m/2$) plus the expected capital gain on holding food stocks ($\dot{R}^e F/2$) 8/; real wealth is the sum of money balances and food stocks F.

7/ Given the Cobb-Douglas technology (with the fixed factor suppressed in our notation), the factor shares are α and $(1-\alpha)$ in the food sector and β and $(1-\beta)$ in the nonfood sector.

8/ Because our focus is not on the effects of differential tax burden, it has been assumed that the income and wealth of landlords and capitalists are taxed equally.

The private sector's demand for food is comprised of the demands of all employed workers in the two sectors plus those of capitalists in the nonfood sector. The demand of workers is simply the aggregate wage bill $(\alpha\bar{Q}_f + \frac{\beta}{R} Q_{nf}(R))$ which varies negatively with R. The demand of capitalists depends positively on their disposable income and on their real wealth. 9/ Adding up, the total demand for food is

$$\alpha\bar{Q}_f + \frac{\beta}{R}Q_{nf}(R) + C_f\left[\left(\frac{1-\beta}{R}\right)Q_{nf}(R) - \frac{1}{2R}(\tau - \pi_{nf}m + \dot{R}^e F),\ \frac{1}{2}\left(\frac{m}{R} + F\right)\right] + g_f \qquad (12)$$

$$\delta C_f/\delta R < 0, \quad \delta C_f/\delta F > 0$$

Asset market equilibrium is described by a portfolio balance equation

$$\frac{RF}{m+RF} = \xi(\pi_f) \qquad 0 < \xi < 1, \quad \xi'() > 0 \qquad (13)$$

where π_f is the expected rate of increase in food prices (which equals the difference between the real return on food stocks and the real return on money). Equation (13) underlines the belief that the price of food is determined in what Hicks (1974) refers to as a "flexprice" market: the equilibrium of the food market is a stock equilibrium, not a flow equilibrium.

In what follows, agents (in effect, landlords and capitalists) are assumed to possess long-run perfect foresight, which is to say that expected inflation equals actual inflation in the long run and that expected capital gains from holding food stocks is zero. Consequently, one can set $\pi_f = \pi_{nf} = \pi = \mu$ and so $\dot{R}^e = 0$ in (11)-(13).

As the nonfood market clears continuously, we have

$$Q_{nf}(R) = C_{nf}\left[R\bar{Q}_f(1-\alpha) - \frac{\tau}{2} - \frac{\mu m}{2},\ \frac{m + RF}{2}\right] + g_{nf}$$

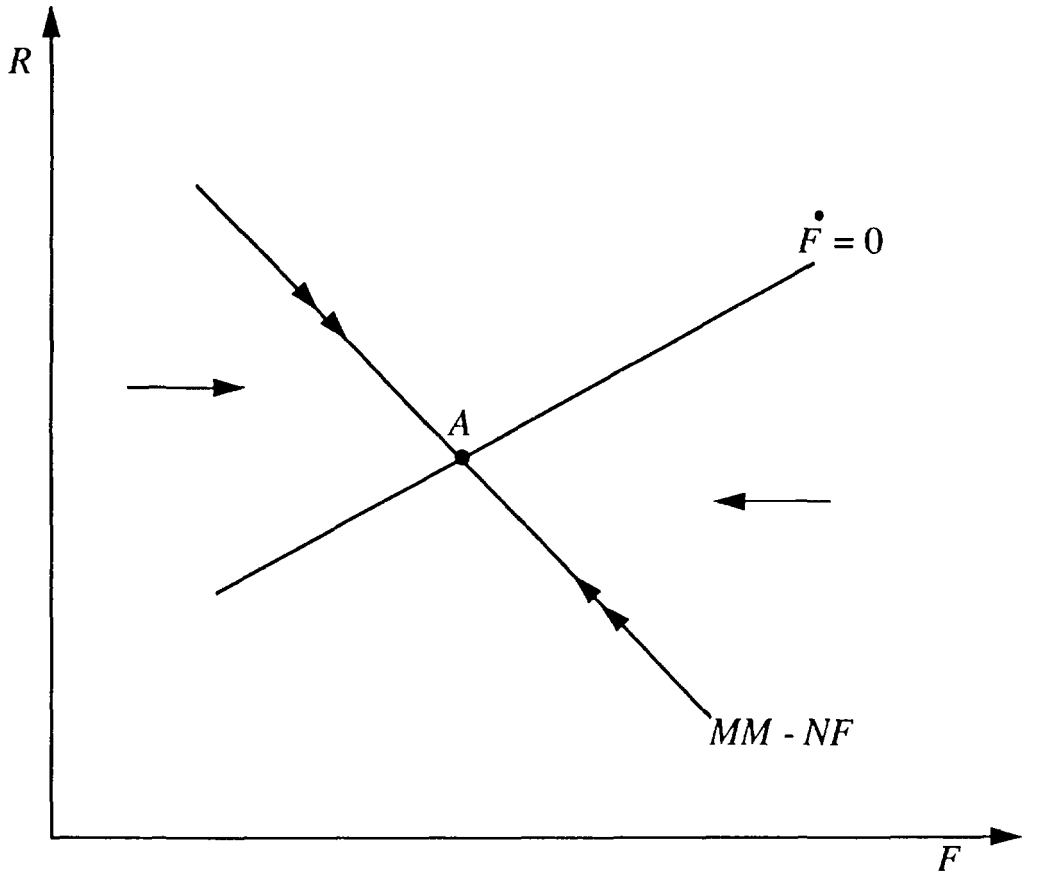
Substituting (10) and (13) in the above equation we obtain

$$Q_{nf}(R) = C_{nf}\left[R\bar{Q}_f(1-\alpha) - \frac{Rg_f - g_{nf}}{2},\ \frac{RF}{2\xi(\mu)}\right] + g_{nf} \qquad (14)$$

Equation (14), graphed as the MM-NF schedule in Fig. 3, is the locus of simultaneous equilibrium in nonfood and asset markets.

9/ As capitalists consume only food, income and wealth are both expressed in terms of food.

Figure 3
Dynamic Equilibrium of the Economy



Finally, in the food market, the difference between output and consumption yields an equation for accumulation of food stocks

$$\dot{F} = \bar{Q}_f - C_f(R, F; g_f, g_{nf}, \mu) - \alpha\bar{Q}_f - \frac{\beta}{R} Q_{nf}(R) - g_f \qquad (15)$$

$$\delta\dot{F}/\delta R > 0, \quad \delta\dot{F}/\delta F < 0$$

$$\delta\dot{F}/\delta g_f < 0, \quad \delta\dot{F}/\delta g_{nf} > 0, \quad \delta\dot{F}/\delta\mu > 0$$

where we have made use of (10), (12), and (13).

This is graphed as the $\dot{F} = 0$ line in Fig. 3, with the arrows corresponding to the dynamics implied by the derivatives. Graphically, the equilibrium path of the economy towards its steady state solution A always involves moving along MM-NF (in order to assure that asset and nonfood markets clear continuously) in a manner consistent with the dynamics of the $\dot{F} = 0$ schedule, i.e. following the double arrows.

IV. Analysis of a Monetary Disturbance

Consider the effect of an increase in the rate of monetary growth μ. In order to focus on the purely monetary aspect of the experiment, it is assumed that g_f and g_{nf} are held constant, so that the increase in μ is motivated by an exogenous decline in τ.

From (14) and (15), it is apparent that both the MM-NF and the $\dot{F} = 0$ schedules shift out and to the right. It is easily verified that the right horizontal shift is the same for both schedules ($= \bar{F}\frac{\xi'}{\xi}$), so that R is unchanged across steady states. 10/ This is depicted in the right panel of Fig. 4; the left panel merely consolidates Fig. 2 and allows one to track the implications for employment and unemployment.

The immediate impact is for the economy to jump to point A' before traversing MM'-NF' to the new steady state B. Most monetary models predict an overshooting of the overall inflation rate when the growth of money is increased, because the implied decline in real balances can only be achieved if prices rise faster than the money supply. Our model, like that of Calvo and Rodriguez (1977), additionally predicts an overshooting (really, a temporary increase) of relative prices.

10/ It can be shown that real wealth is unchanged across steady states, the increase in F being exactly offset by a fall in m. Similarly, our model fully satisfies the homogeneity postulate: a once and for all increase in nominal cash balances causes all prices to jump in the same proportion as the increase in money supply.

The sharp rise in R is caused by the attempt of landlords and capitalists to protect their wealth from the now higher inflation tax by holding more food stocks and less money. However, the only way to make additional food stocks available is to lower food consumption--notably that of the working class--which is precisely what an increase in R achieves. The increase in R inhibits consumption not merely in the usual way that higher relative prices do, but also by generating involuntary unemployment in the nonfood sector, a phenomenon Sen (1981) has termed "derived destitution." Lacking entitlement to food, the newly unemployed in the nonfood sector are forced to wait out the portfolio readjustment by begging or scavenging. However, if the monetary shock is sufficiently severe--and correspondingly prolonged--they will not succeed since there are obvious limits to any society's ability to support an unproductive class. 11/ At this point, hunger can quickly give way to famine.

It should be emphasized that the famine occurs despite completely unchanged per capita food availability. This feature of our model accords well with the empirical evidence presented in Sen (1981). On this view, famine is not so much a question of per capita food availability but rather of the distribution of food entitlement across society. The point we wish to stress is that monetary policy is a key determinant of that distribution in the short run: large and sudden increases in the rate of monetary growth hold the potential for creating famines. By the same token, in a situation where a temporary supply shock may be the precursor to famine, a tight monetary policy could augment direct relief efforts by reducing the incentives to hoard foodgrains and by increasing food entitlement.

V. Fiscal Policy

We begin by analyzing the effects of a tax-financed increase in government expenditure, thus stripping the government's intervention of any monetary implications. For concreteness, consider a move to permanently increase g_f, with the apparent aim of increasing food transfers to the unemployed poor. 12/ What is the impact of this balanced fiscal expansion?

In Fig. 5, the $\dot{F} = 0$ schedule shifts up and to the left since a higher R is required to offset the increased demand at each level of wealth. Likewise, the MM-NF schedule shifts up to the right since

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11/ The interregnum between steady states could be modelled more formally in terms of "the market for beggars" (the demand for begging and the supply of alms), a macabre extension not pursued here.

12/ The effect of an increase in g_{nf} works in precisely the opposite direction as the case analyzed below.

Figure 4
Effect of an Increase in Monetary Growth

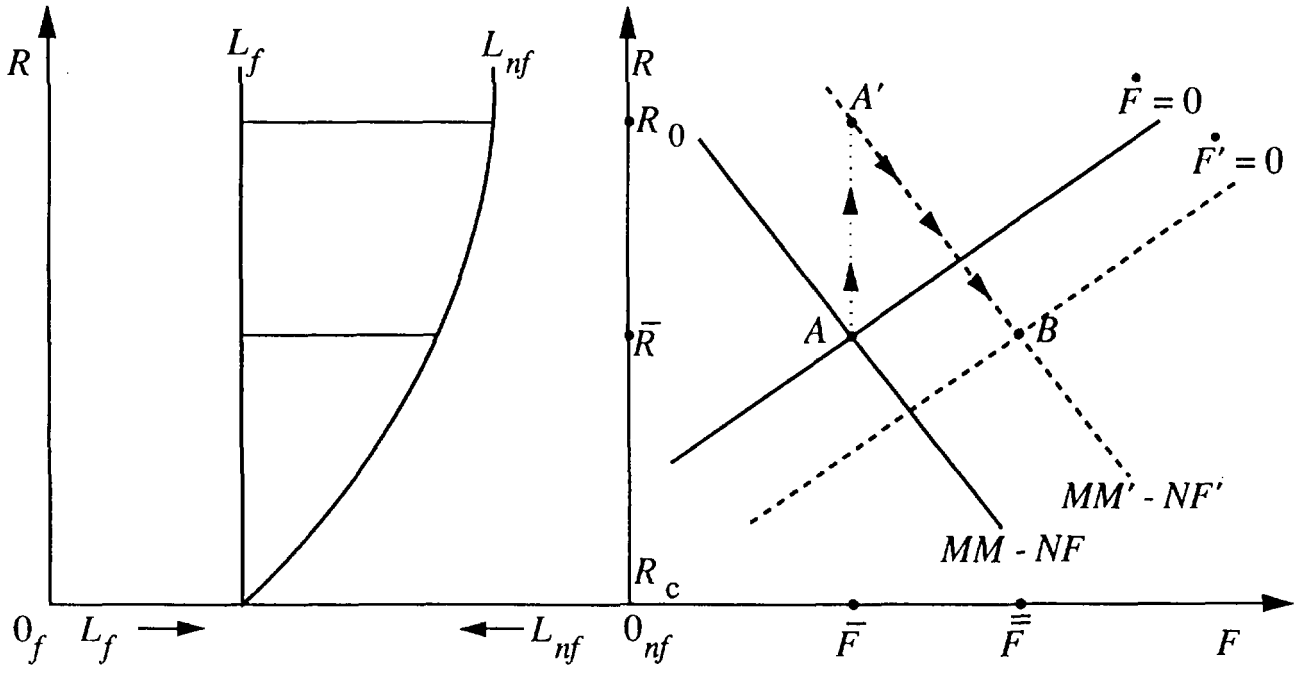
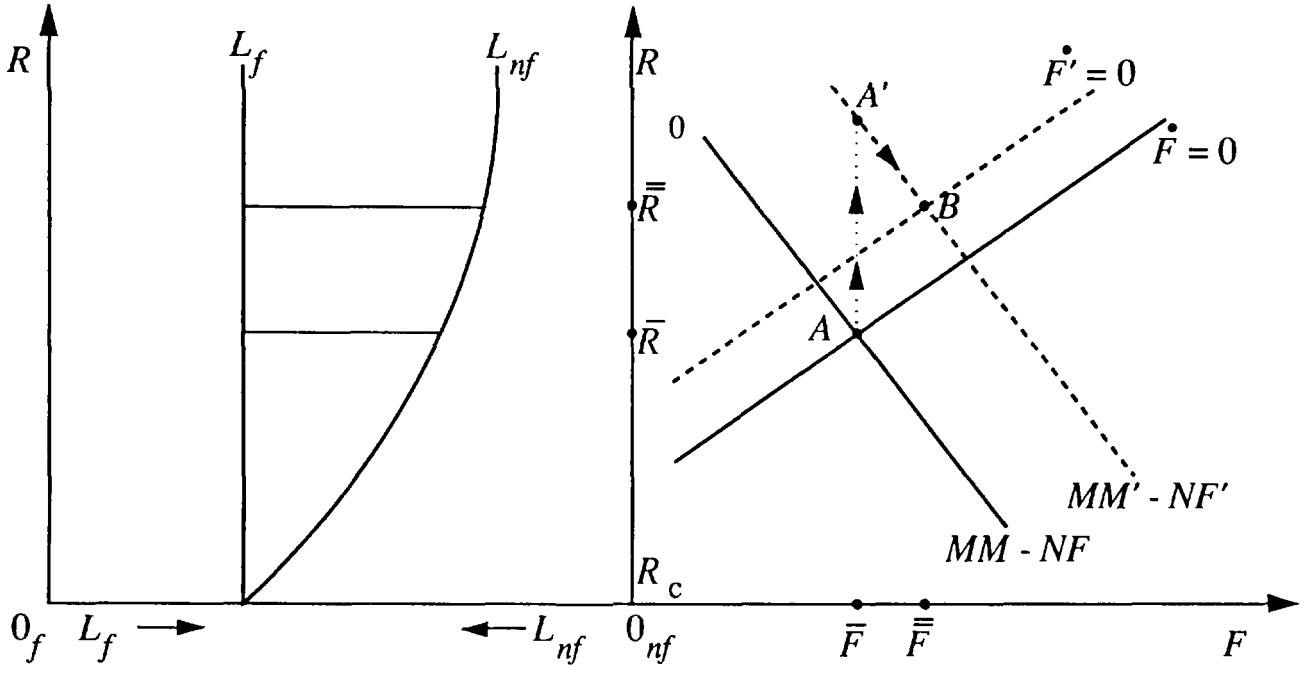


Figure 5
Effect of a Tax-financed Increase in Food Expenditure



capitalists must pay some additional taxes without any offsetting expansion in the demand for their output. The new steady state equilibrium is characterized by a higher relative price of food and by lower employment. The impact effect also calls for a decline in employment, although there may be under- or overshooting of R--and hence in total employment--depending on whether steady state F rises or falls (in general, this last effect is ambiguous). The unemployment is caused by the higher demand for food which raises food prices and reduces profitability in nonfood production, thus crowding out employment in that sector.

Unlike Keynesian models, the effect of a balanced budget increase in food expenditures here is contractionary rather than expansionary. In a sense, the fall in employment is analogous to what might have happened in a more traditional two sector neoclassical macro model where any fiscal action that increases the relative cost of wage goods leads to a contraction of labor supply (labor supply depends on nominal wages deflated by the cost of wage goods, while labor demand depends on real product wages) and hence to a decline in total employment. Of course, in the neoclassical setup, the unemployment is voluntary, whereas in our model it is involuntary.

With regard to the role of government food expenditure in the alleviation of hunger, it is essential to bear in mind two points. First, although the newly unemployed are certainly worse off as a result of the intervention, one cannot conclude from this that social welfare is necessarily reduced. For relatively flat schedules on the left panel of Fig. 5 (and a steep L_{nf} schedule on the right), the loss in food entitlement for the newly unemployed may be a relatively small price to pay for higher entitlements bestowed on the chronically unemployed. In any event, the government must recognize that there is a trade-off here.

Second, our conclusion that higher government expenditure may increase unemployment and hunger does not imply that the government should refrain from intervening in the presence of famine. Thus, if a drought temporarily reduces food output and threatens to lead to severe famine, the first-best policy response is to make food available to the needy in a manner that does not drive up its price further: i.e., by drawing down government buffer food stocks. If these are inadequate, the government will have to make market purchases of food at the worst possible time, and this may have adverse effects that need to be recognized. Our model thus argues for the maintenance of adequate buffer food stocks (built up in "good years" through <u>temporarily</u> higher government purchases) rather than government inaction.

VI. The Open Economy

This section opens up the basic model to the effects of international trade and, more specifically, to the analysis of the effects of changes in world prices and the exchange rate. To keep the model as simple as possible, food is taken to be the only tradeable good; there is no trade in financial assets. With a given world price p_f^* and exchange rate E (domestic price of foreign currency), the domestic price of food then is Ep_f^*. This means that, exogenous changes in E and p_f^* apart, variation in R reflects changes in the nominal price of nonfood.

Given that the economy in question is assumed to peg its exchange rate, the nominal money supply is endogenous. For simplicity assume that budgetary expenditures are precisely balanced by direct domestic taxes so that there is no trend growth in the money supply in the initial steady state. The asset equilibrium condition (13) can then be rewritten as

$$\frac{F}{\frac{M}{Ep_f^*} + F} = \bar{\xi} \text{ (constant)} \tag{16}$$

where M is the nominal money supply.

By definition, the current account equals net private and public sector savings or, equivalently, the difference between output of traded goods (food) on the one hand, and consumption plus hoarding of food on the other. With capital immobile, the change in the central bank's foreign reserves B (measured in units of food), may be expressed as

$$\dot{B} = \bar{Q}_f - C_f(R, \frac{M}{Ep_f^*} + F) - \alpha\bar{Q}_f - \frac{\beta}{R} Q_{nf}(R) - \dot{F} + (\frac{\tau}{R} - g_f) \tag{17}$$

where the terms on the right respectively signify output of food and its consumption by capitalists and workers (the latter is the sum of the wage bill in each sector); the last term is the government's food consumption net of taxes.

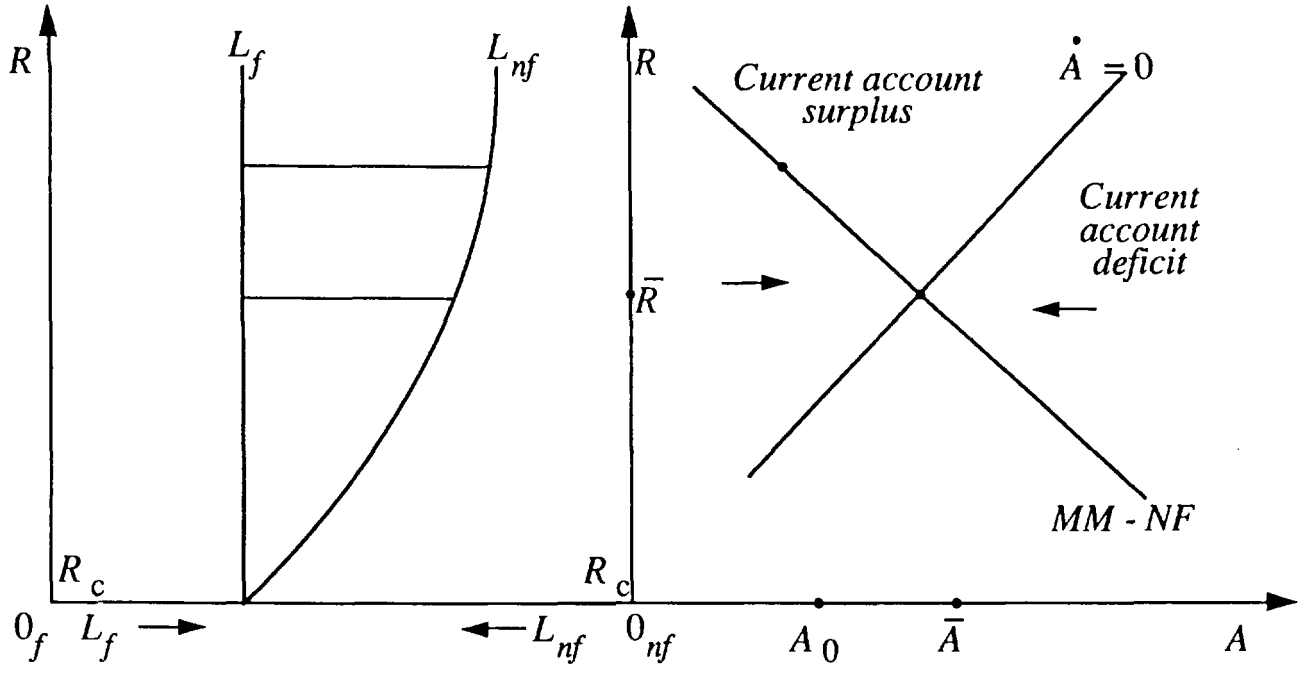
From the central bank's balance sheet, the assumption of zero monetization of the budget deficit implies that the change in money supply (reserve money) exactly equals the current account surplus

$$(\frac{\dot{M}}{Ep_f^*}) = \dot{B} \tag{18}$$

Substituting (18) in (17) and writing $A \equiv \frac{M}{Ep_f^*} + F$,

$$\dot{A} = (1-\alpha)\bar{Q}_f - \frac{\beta}{R} Q_{nf}(R) - C_f(R, \frac{A}{2}) + (\frac{\tau}{R} - g_f) \tag{19}$$

Figure 6
Effect of an Increase in World Food Prices/Devaluation



This yields a new asset accumulation schedule in A and R space, graphed as the $\dot{A} = 0$ schedule in Fig. 6, with the arrows depicting the dynamic properties implied by (19). Note that to the left of the $\dot{A} = 0$ schedule, consumption is lower than in the steady state, and the economy runs a current account surplus; to the right, the current account is in deficit.

Similarly, substituting (16) in (14) yields a revised MM-NF schedule

$$Q_{nf}(R) = C_{nf}[R\bar{Q}_f(1-\alpha) - \frac{Rg}{2}f - \frac{g}{2}nf, \frac{RA}{2\bar{\xi}}] + g_{nf} \qquad (20)$$

The open economy version of the model is summarized by equations (19) and (20) and depicted in Fig. 6. Once again, the economy is constrained to always move along the MM-NF (where the market for nontradables and assets clear continuously) though in a manner consistent with the dynamics of the $\dot{A} = 0$ schedule.

Consider now the effects of an increase in the world price of food. Neither schedule is affected by the change in the domestic price of food. However, because real balances in terms of food are suddenly lower at A_0, the economy will move to a corresponding point on the MM-NF schedule. The immediate impact is thus for an increase in the relative price of food. This compresses consumption, in our model by means of a recession, and leads to a succession of current account surpluses that bring about a recovery in real balances. At the end of the day, real wealth is where it began, but the economy has shed some of its surplus labor through hunger and starvation.

The effects of a devaluation are exactly the same, with real output and wealth independent of the nominal exchange rate in the long run. Of course, it is somewhat artificial to devalue the exchange rate while in steady state equilibrium. Typically, the economy will be somewhere below the $\dot{A} = 0$ schedule when a devaluation is undertaken, in which case the effect of a devaluation consists chiefly of hastening the economy towards its steady state level of employment rather than being a cause of unemployment per se.

It is easy enough to verify that both tax and money-financed increases in g_f will result in a higher R. However, this is only so to the extent that we have ruled out the possibility of capital flows. Capital inflows provide the fiscal authorities with an added degree of freedom when confronted with a nascent famine. Higher food expenditure can now be financed by foreign aid or by external borrowing--and, of course, by use of buffer stocks--without exerting further pressure on the relative price of food. Needless to say, foreign borrowing may

still involve some increase in the relative price of food to the extent that agents recognize the future tax implications of such borrowing.

VII. Bangladesh, 1974: An Example 13/

In the latter half of 1974, the people of Bangladesh experienced what might be termed a "classic" famine: summer floods, autumn famine. Between late June and early September, the river Brahmaputra crossed the danger mark five times, causing extensive flooding on each occasion. Although there were reports of increased hunger and starvation as early as July, the peak famine months were September through November. This sequence of events has led a number commentators (e.g., Etienne (1977)) to conclude that it was the destruction of the summer and autumn rice crop that was responsible for the death of up to 1 million people. 14/

However, in Tables 1 and 2, "the facts speak for themselves." First, rice production was actually higher in 1974 than in the years preceding and succeeding the famine. Second, per capita food availability--defined as rice and wheat production plus foodgrain imports--was also higher in 1974 than in the years surrounding the famine. Third, disaggregating these totals, both food output and food availability were considerably higher in four of the five districts most severely affected by the famine; in fact, for all 19 districts, Sen (1981) reports that the rank correlation coefficient between famine intensity and lowness of output growth is minus 0.5.

Clearly, lack of food availability did not cause the famine, and the overall supply situation in the years surrounding the disaster, far from alternating between famine and feast, is more one of famine amidst feast. Our approach in this paper has been to focus on food entitlement, as reflected in the relative price of food. Fig. 7, which presents monthly data on inflation and the relative price of food, indicates that the two were generally stable during the first half of 1974. However, starting in July, there was a sharp upward jump in inflation and in R that was only gradually reversed in subsequent months. Corresponding to this increase in the relative price of food was a large outflow of workers and peasants from rural areas to relief centers, towns, and cities. Who were these destitutes that, in

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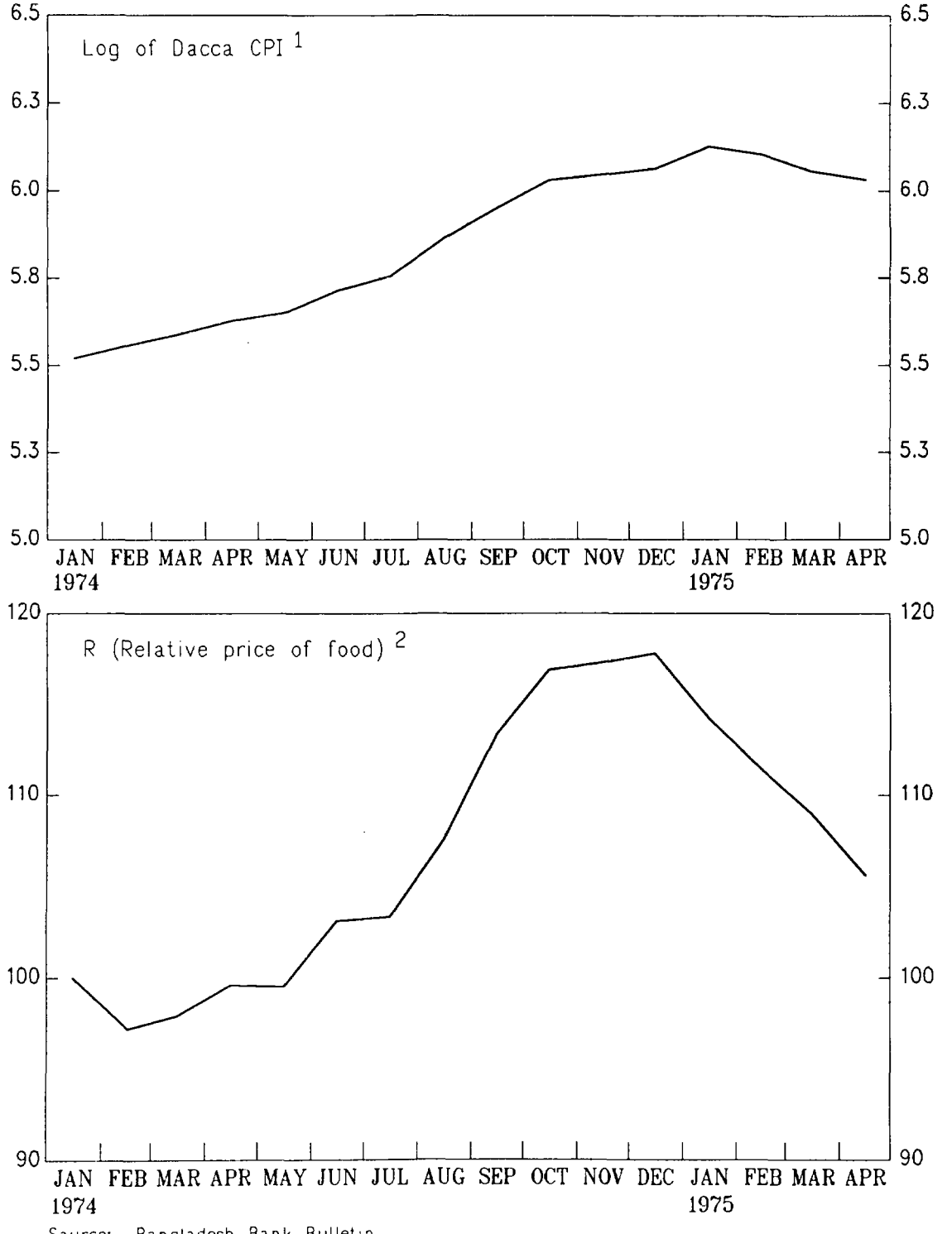
13/ This section draws heavily on Alamgir (1980, pp. 101-150) and Sen (1981, pp. 131-153).

14/ Estimates of the death toll vary. Alamgir (1980) attributes about 1 million deaths due to famine between August 1974 and January 1975 and possibly another half million in subsequent months due to the secondary effects of the famine (epidemics of cholera, smallpox, diarrhea, and dysentery). The official death figure is 26,000.

FIGURE 7
BANGLADESH
PRICE DEVELOPMENTS, 1974–75



Source: Bangladesh Bank Bulletin.
[1] 1969/70 = 100
[2] January 1974 = 100

Table 1. Bangladesh: Rice Output, 1971-75 1/

Year	Production of rice (thousand tons)	Index of rice production	Per Capita rice output (tons)	Index of per capita rice output
1971	10,445	100	0.133	100
1972	9,706	93	0.120	90
1973	10,459	100	0.126	95
1974	11,778	113	0.139	105
1975	11,480	110	0.132	99

Source: Data taken from Table 6.4 of Alamgir (1980).

1/ The three main rice crops are boro (harvested in April-June) which accounts for 20 percent of annual production; aus (harvested in July-August), 25 percent; and aman (harvested in November-January), 55 percent. As the peak of the Bangladesh famine coincided with the aus harvest and preceded aman, the production-based supply of rice is obtained by adding the previous year's aman crop to the current year's aus and boro crop.

Table 2. Bangladesh: Foodgrains Availability, 1971-75

Year	Total available foodgrains for consumption (million tons)	Population (millions)	Per capita availability (oz./day)	Index of per capita availability
1971	10.740	70.679	14.9	100
1972	11.271	72.535	15.3	103
1973	11.572	74.441	15.3	103
1974	12.355	76.398	15.9	107
1975	12.022	78.405	14.9	100

Source: Data taken from Table 6.23 of Alamgir (1980).

Alamgir's (1980, p. 128) account, "after a few days of wandering around the streets of the city simply collapsed and died"?

The occupation structure of inmates in langarkhanas (relief centers) and occupation-specific mortality rates (Tables 3 and 4) both confirm that it was workers in the nonfood sectors--transportation workers, traders, and wage labor--that were hardest hit. Sen (1981) explains the relatively high ranking of "farmers" in these tables by arguing that this category consisted chiefly of very small farmers, doubtlessly food deficit households that normally rely on nonfood-producing activities for survival. Similarly, production data also supports this picture of distress concentrated in the nonfood sector, including nonfood agriculture: the sharp decline in acreage devoted to jute--the other major agricultural crop--was matched by an increase in land devoted to rice production. Although such substitutability of land use undoubtedly mitigated the effects on unemployment, the offset was not complete since jute is a relatively more labor-intensive crop.

These features of the Bangladesh famine--no decline in food production, an increase in the relative price of food, and a loss of food entitlement concentrated in the nonfood sector--accord nicely with the model developed in previous sections. But then, what caused the increase in the relative price of food?

Figs. 8-10 present data on the growth of various monetary aggregates. All monetary aggregates--particularly the narrowest ones that generally track the price level most accurately--show a sharp acceleration just prior to the famine and a subsequent decline in early 1975 back to the pre-famine level. The initial impulse to the rapid expansion of the monetary base appears to have been given by the financial difficulties experienced by public sector enterprises: the public corporations approached the nationalized commercial banks who, in turn, obtained credit from the central bank.

The data thus suggests a transmission mechanism along the following lines. Higher monetary growth raised inflation and inflationary expectations to unprecedented levels and encouraged a portfolio shift towards food stocks. 15/ This contributed to a sharp increase in the relative price of food which not only aggravated the distress of existing destitutes but also resulted in derived destitution in the nonfood sector where, in Alamgir's (1980, p. 121) words, "laborers turned into beggars."

15/ Although real money balances (however defined) did indeed fall sharply, data on food stocks held by households and traders is scant, so this proposition, plausible as it is, remains conjectural. Stocks held by small and marginal farmers, i.e. by food deficit households, probably declined as they were forced by the circumstances to literally eat their wealth. However, as noted by Alamgir (1980, p. 249) "surplus farmers were found to carry stocks of foodgrain for periods longer than usual."

Table 3. Bangladesh: Occupational Distribution of Destitution in 1974

Occupation	Number of langarkhana inmates	Percentage of total langarkhana inmates
Laborers	351	44.5
of whom: (i) agricultural laborers	190	24.1
(2) other laborers	161	20.4
Farmers	305	38.8
Others	132	16.8
Total	788	100.0

Source: Table 5.3 of Alamgir (1980).

Table 4. Bangladesh: Occupation-specific Mortality Rates in Selected Villages, August-October 1974

Occupation	Death rate per 1,000	Death rate among children 10 years and below per 1,000
Transport	100	286
Wage labor	88	128
Trade	53	80
Farming	38	64
Services	16	12
"Others"	29	n.a.
Total	47	74

Source: Table 5.5 of Alamgir (1980).

In responding to reports of increased starvation, it would seem that the story told by Figs. 7-10 was not foremost in the minds of the authorities, although attempts were made later in the year to limit bank credit to the private sector. Viewing the famine as an essentially sectoral--rather than monetary--phenomenon, the government introduced a compulsory rice procurement program in the fall of 1974. However, in order to implement the program, restrictions were imposed on the inter-district movement of food which tended to depress free market prices in rice surplus areas (where the loss in food entitlement was the least) and to raise prices in deficit areas (where the problem of starvation and inadequate food entitlement was most severe). Ultimately, there was no escape from the fundamental constraint facing the government in its relief operations: inadequate food stocks. The famine finally came to an end in late 1974, at about the same time the monetary expansion was reversed.

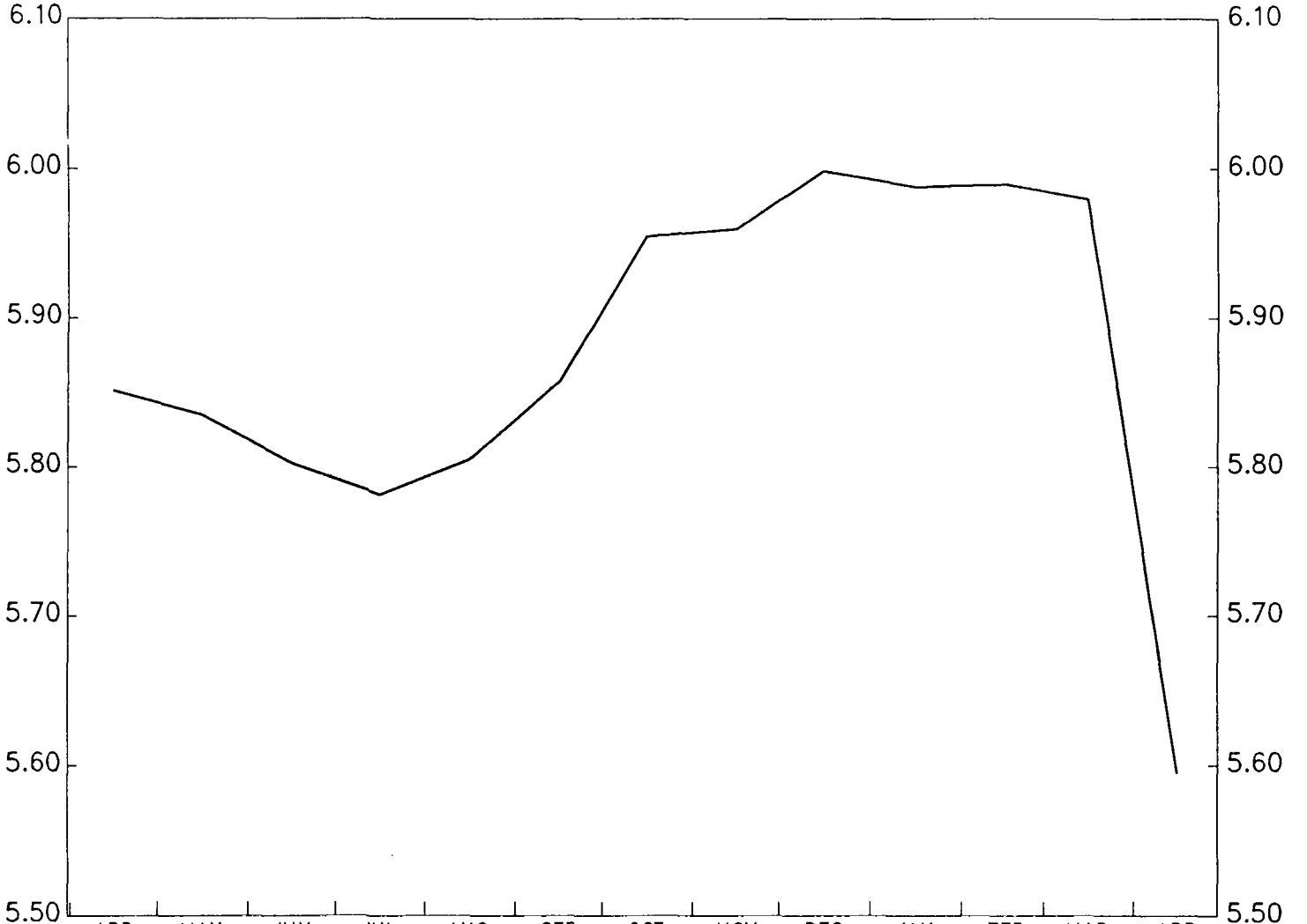
We find in this general account a striking affirmation of the points made in Section IV. The progression from higher monetary growth to a higher relative price of food and, ultimately, to an increased incidence of hunger concentrated in the nonfood sector, is at the very least highly suggestive. In searching for the underlying causes of the famine, it goes without saying that there are any number of additional factors--such as disruption of transportation and communications and weaknesses in the distribution system--that undoubtedly contributed to the tragedy. However, an analysis of each of these is beyond the scope of this paper.

We are aware that the foregoing does not "prove" that monetary explosions cause famine to the extent that one can ask--must ask--why some expansionary episodes lead to famines but not others? In the context of our model, there are a number of possibilities: (i) some monetary accelerations may not induce portfolio shifts (and hence an increase in the relative price of food) because they are expected to be temporary; (ii) exogenous, and purely coincidental, increases in food production may offset the incipient increase in the relative price of food; (iii) over time, the development of capital markets may make available more attractive hedges against inflation--which dissipates the demand pressure on physical assets such as foodgrains. In any event, the basic point remains that slippages in macroeconomic policies hold the clear potential for creating or exacerbating famines; the policy response to reports of increased hunger should not dismiss this possibility as a second-order complication.

VIII. Concluding Remarks

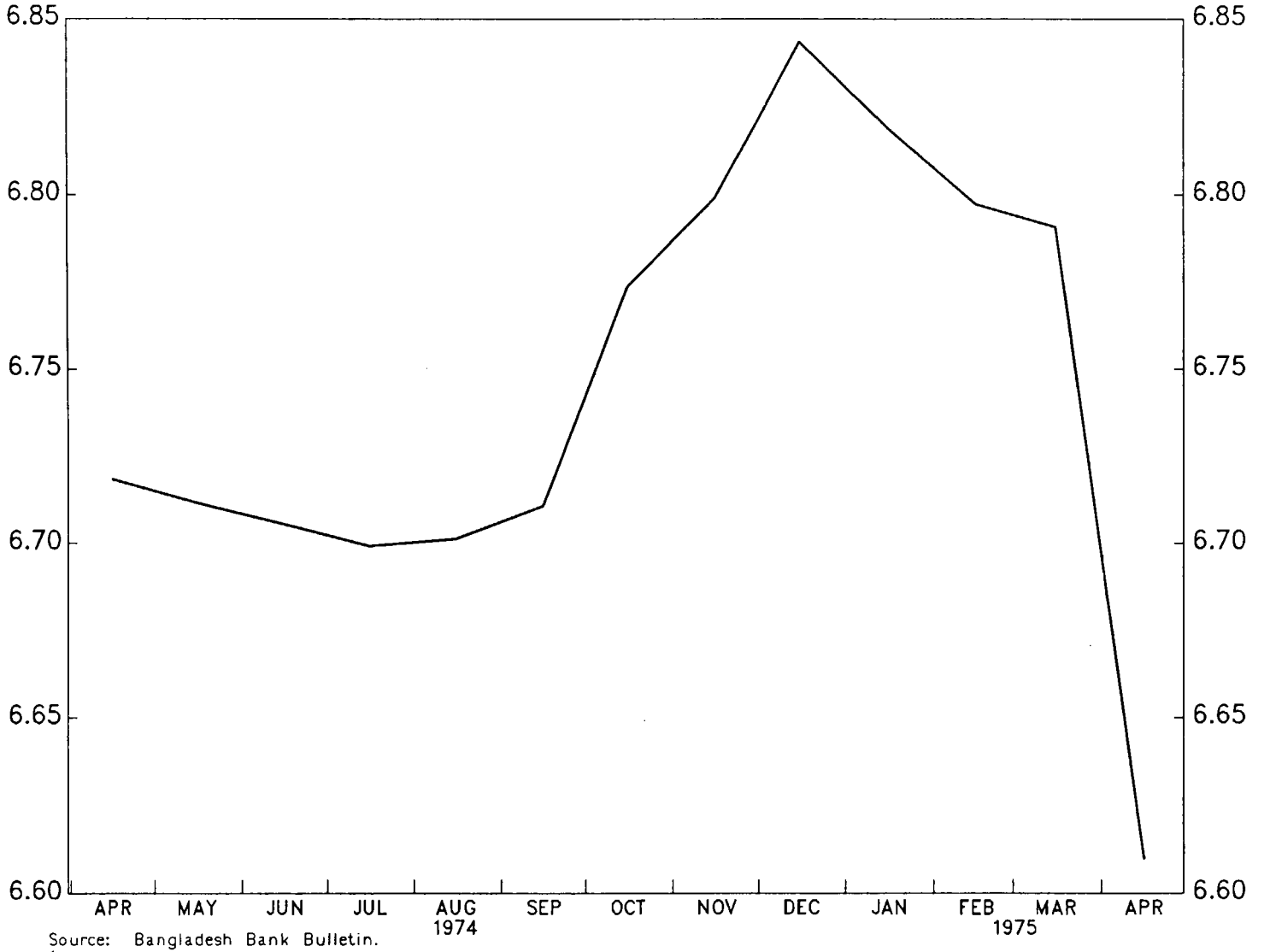
The aim of this paper has been to shift the focus of famine analysis from food supply to the macroeconomic determinants of food entitlement. Excessive interest in per capita food availability statistics may only serve to distract attention from impending disaster and to postpone required adjustment in monetary and fiscal policies.

FIGURE 8
BANGLADESH
GROWTH OF CURRENCY, 1974–75 [1]



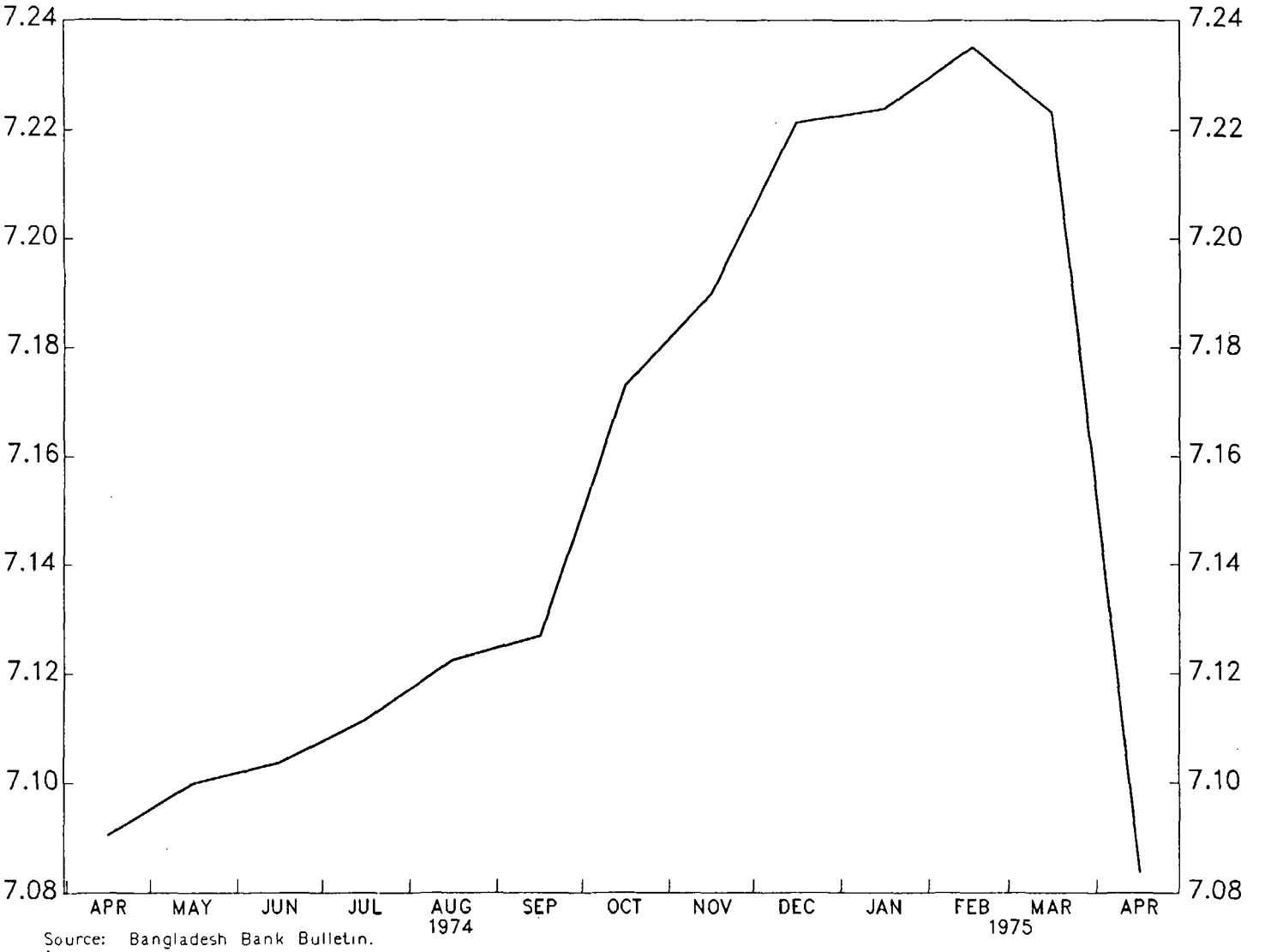
Source: Bangladesh Bank Bulletin.
[1] Graph depicts logarithm of currency.

FIGURE 9
BANGLADESH
GROWTH OF NARROW MONEY 1974–75 [1]



Source: Bangladesh Bank Bulletin.
[1] Graph depicts logarithm of narrow money.

FIGURE 10
BANGLADESH
GROWTH OF BROAD MONEY 1974–75 [1]



Source: Bangladesh Bank Bulletin.
[1] Graph depicts logarithm of broad money.

As regards the model used to illustrate this point, we would like to emphasize two points. First, the basic ideas and results in this paper are quite general and not the product of a somewhat unorthodox macro model. Specifically, the use of efficiency wages as a modelling strategy was motivated by a desire to simulate two central features of most famines: (1) unchanged output of food, and (2) loss of food entitlement both directly through a higher relative price of food and indirectly through derived destitution (involuntary unemployment). However, similar results could be obtained using more conventional approaches, for example, by assuming fixed coefficient technologies to generate unemployment and reduced food entitlement. 16/ In any event, the standard neoclassical model is not a good starting point for thinking about famines: it is difficult to imagine mass starvation amidst a homogeneous and fully employed labor force.

Second, as with any theoretical construct, the model should be interpreted with caution and common sense. Not every increase in the relative price of food causes unemployment (as when $R < R_c$ in Section III); nor does every monetary expansion lead to famine (as discussed in Section VII). Moreover, as the output of food is fixed, the model is not really suitable for thinking about the longer-term issues of adequate producer price incentives and food security.

The main practical point emerging from our model is that expansionary monetary and fiscal policies may cause or exacerbate famines. Once a famine is under way, an effective response requires steps to increase the food entitlement of the affected population. The first-best policy is the direct provision of food from existing buffer stocks. (Alternatively, if foreign grants or concessional foreign borrowing are available, imported food could be distributed to the affected population.) In contrast, domestic fiscal operations to procure and distribute foodgrains when a famine is already in place tend to drive up the relative price of food and exacerbate the problem of inadequate food entitlement. Likewise, efforts by the monetary authorities to "accommodate" an actual or perceived supply shock to the food sector can only worsen the problem by further increasing the relative price of food.

Consciously or unconsciously, these lessons have not been lost on policymakers in Bangladesh. The 1988 floods would, by all accounts, appear to have been at least as severe as those in 1974. But whatever the extent of individual loss and deprivation, there was no widespread starvation or famine in the autumn of 1988. Instead, a greatly enlarged food distribution system, developed over the past ten years, allowed the government to respond quickly by drawing on its ample buffer stocks.

16/ Thus, even if food output responded positively to relative prices in the short run, this would not reverse our results but only modify the magnitudes.

Equally important, the budget deficit was kept under control and, as a result, monetary growth remained stable. The increase in the relative price of food was modest and quickly reversed.

Our emphasis in this paper has been more on developing a theoretical framework and providing a plausible example, and we are aware that the 1974 Bangladesh famine does not "prove" that loose monetary and fiscal policies cause famines in underdeveloped countries. Obviously, no one hypothesis can ever hope to explain a complex phenomenon; nevertheless, we are convinced that a thorough empirical investigation of the relationship between famine and macroeconomic variables will prove to be a fruitful area for future research.

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