

# The Dangers of Monetary Policy in Agrarian Economies

RICHARD C. PORTER\*

## SECTION I

The central banks of underdeveloped economies are frequently admonished for their apparently permissive attitude toward inflation. Where large government deficits are financed by the creation of ever-larger money balances in the economy, this criticism is quite apt. But the strictures often extend to those central banks which, in a situation where prices have *already* risen for reasons beyond their control,<sup>1</sup> are reluctant to refuse the accommodating expansion of the money supply. With the argument that the central bank *can* force prices back to their previous levels merely by insisting that the money supply does not increase, central bankers and their supporters have seldom disagreed. They justify permissive after-the-fact monetary expansions on the grounds that driving the price level back down would have unfortunate side effects.<sup>2</sup>

The purpose of this paper is to show that, in agrarian (or predominately agricultural) economies it may be *impossible* to counteract apparently temporary shifts in the price level by means of traditional monetary policy. A permanently higher price level may be easily maintainable even if no increase in the money supply occurs. The desired real wealth holdings of the agricultural sector, made inadequate by the rise of prices, may be restored by increases in non-money wealth holdings. Thus, the traditional mechanism by which inadequate real money balances lead to a decline in the price level<sup>3</sup> may be absent in underdeveloped economies where a significant portion of the populace has ready access to an alternative form of liquid wealth—unsold, unconsumed, self-produced foodgrains.

As a result, an increased price level can be maintained *whether or not*

---

\*Dr. Porter is Research Adviser to the Institute of Development Economics. Much of the argument of this paper originated in discussions with F.C. Shorter of Princeton University, and this final version owes a heavy debt to him. The author is also very grateful to T. N. Srinivasan of Yale University for correcting several errors in the Mathematical Appendix. Both H. J. Bruton and M. U. Chapra of the Institute read and commented upon drafts of this paper. Any errors that remain are, of course, the sole responsibility of the author.

1. For example, as a result of crop failures, a rise in urban wages, or an unexpected shift in the terms of trade.

2. As, for example, inequities or temporary idle capacity.

3. See D. Patinkin, *Money, Interest and Prices*, Row, Peterson & Co., 1956.

# The Dangers of Monetary Policy in Agrarian Economies

RICHARD C. PORTER\*

## SECTION I

The central banks of underdeveloped economies are frequently admonished for their apparently permissive attitude toward inflation. Where large government deficits are financed by the creation of ever-larger money balances in the economy, this criticism is quite apt. But the strictures often extend to those central banks which, in a situation where prices have *already* risen for reasons beyond their control,<sup>1</sup> are reluctant to refuse the accommodating expansion of the money supply. With the argument that the central bank *can* force prices back to their previous levels merely by insisting that the money supply does not increase, central bankers and their supporters have seldom disagreed. They justify permissive after-the-fact monetary expansions on the grounds that driving the price level back down would have unfortunate side effects.<sup>2</sup>

The purpose of this paper is to show that, in agrarian (or predominately agricultural) economies it may be *impossible* to counteract apparently temporary shifts in the price level by means of traditional monetary policy. A permanently higher price level may be easily maintainable even if no increase in the money supply occurs. The desired real wealth holdings of the agricultural sector, made inadequate by the rise of prices, may be restored by increases in non-money wealth holdings. Thus, the traditional mechanism by which inadequate real money balances lead to a decline in the price level<sup>3</sup> may be absent in underdeveloped economies where a significant portion of the populace has ready access to an alternative form of liquid wealth—unsold, unconsumed, self-produced foodgrains.

As a result, an increased price level can be maintained *whether or not*

---

\*Dr. Porter is Research Adviser to the Institute of Development Economics. Much of the argument of this paper originated in discussions with F.C. Shorter of Princeton University, and this final version owes a heavy debt to him. The author is also very grateful to T. N. Srinivasin of Yale University for correcting several errors in the Mathematical Appendix. Both H. J. Bruton and M. U. Chapra of the Institute read and commented upon drafts of this paper. Any errors that remain are, of course, the sole responsibility of the author.

1. For example, as a result of crop failures, a rise in urban wages, or an unexpected shift in the terms of trade.

2. As, for example, inequities or temporary idle capacity.

3. See D. Patinkin, *Money, Interest and Prices*, Row, Peterson & Co., 1956.

the central bank expands the money supply. But the two policies (to expand or not) are not the same in their other economic effects. If the money supply is kept constant, foodgrains will be held back from consumption until real wealth balances are restored. In countries where the standard of living is already low, such monetary restriction would impose an unnecessary, though temporary, burden upon the people. Furthermore, it will lead to redistribution of real income in the economy, which may be quite undesirable.

In an economy where food is already a critically scarce commodity, the central bank would be foolish indeed to encourage its hoarding as wealth when some inedible substitute (*i.e.*, money) can easily be made available. Moreover, if traditional central bank policies are ever to be effective in such an economy, monetization (not only of transactions but) of wealth holdings must be stimulated. This cannot be achieved if increased money is not provided when increased wealth balances are desired.

In the remainder of this paper these assertions are proved, though under very simplified conditions. Throughout, a rather rudimentary "agrarian" economy<sup>4</sup> is considered where the only production is of foodgrains and the non-agricultural population is supported by transfers from the agricultural producers. Of course, there is no necessity that the amount of money transferred from agriculturalists be equal to the amount transferred to the non-agricultural sector, for the government might print (or withdraw) currency; since we are concerned with the compatibility of an unchanged money supply with a changed price level, we shall assume a balanced and unaltered government budget.<sup>5</sup>

We shall look at two types of economies, the more "modern" type first. In Section II, it is assumed that *all* wealth balances, in each of the two sectors, are held in the form of money—foodgrains are never hoarded. It will be shown that traditional monetary policy is effective.<sup>6</sup> In Section III, the assumption that agriculturalists hold some portion of their real wealth balances in the form of hoarded foodgrains is introduced. Monetary policy is shown to be uncertain, if not totally ineffective, under these conditions.

## SECTION II

In this agrarian economy, there are only two types of people who may be

<sup>4</sup>. Of the type analysed, in a different context, by N. Georgescu-Roegen, "Economic Theory and Agrarian Economics", *Oxford Economic Papers*, February 1960.

<sup>5</sup>. This budget consists entirely of the transfers mentioned.

<sup>6</sup>. By "effective" is meant merely that (1) for any money supply only one price level equilibrium can be maintained by the economy, and (2) the larger the money supply the higher is that price level. Implicit is the third assumption that the equilibrium is stable and that the effects of disequilibrating shocks disappear rapidly.

conveniently huddled together and prosaically labelled agriculturalists and non-agriculturalists. The agricultural sector produces foodgrains in an amount that may vary as a result of such factors as the caprice of nature but that is unaffected by economic considerations. The government levies an unchanging lump-sum tax in money terms upon this sector.<sup>7</sup> This tax is transferred by that government entirely to the non-agricultural sector whose members produce nothing.<sup>8</sup> Thus the real income of the agriculturalists is their foodgrain production less the real value of their taxes (*i.e.*, the money value of the taxes divided by the price of foodgrains), and the real income of the non-agriculturalists is this real value of the taxes upon the agricultural sector.

The government has incurred budget deficits at some time in the past, for there is a stock of money in the economy, divided between the two sectors and being the entire wealth of these sectors.<sup>9</sup> Foodgrain consumption and real wealth holding are the only economic goods in this economy; hence for each sector we can visualize a demand curve for foodgrains which depends upon real income and real wealth of that sector.<sup>10</sup> An increase in either real income or real wealth of a sector will increase its demand for foodgrain consumption.<sup>11</sup>

We will assume that this economy is initially in equilibrium in the sense that there is no tendency for any of the economic variables to change (given the unchanging flow of foodgrain output, tax and transfer payments, and money supply). But, before proceeding, we must examine more closely the nature of this equilibrium. Most essential is that there is *no saving* (or dissaving) in either sector for that would imply a change in wealth balances. Thus each sector, accepting the price level as given, adjusts its money holdings so as to

---

<sup>7</sup>. None of the conclusions would be altered if the tax were fixed in real terms, *i.e.*, so much foodgrains rather than so many units of currency.

<sup>8</sup>. Except perhaps "social goods". This sector comprises all landlords, civil servants, police, priests, magistrates, soldiers, *etc.*

<sup>9</sup>. There is *no* national wealth; in the strict sense, this money is merely internal debt. That it is generally, though illusorily, considered unencumbered wealth is well-known.

<sup>10</sup>. There is also a demand curve for real wealth which depends upon real income and foodgrain consumption. This we neglect because, by the budget constraint, whatever real income is not devoted to foodgrain consumption must become demand for augmented real wealth balances (and any excess of consumption over real income is demand for diminished real balances).

<sup>11</sup>. The marginal propensity to consume (foodgrains) out of real income will be less than unity. In the present context, this follows from the fact that real wealth is assumed not to be an inferior good. An increase in real income increases both desired consumption flows and desired wealth balances; this latter rise can be achieved only by saving and hence consumption must rise by less than the increase in real income.

achieve a balance between consumption and wealth. If the total real value of money balances which the two sectors together desire is less than the real value actually available (at the existing prices), one (or both) of the sectors will try to rid itself of the excess by increasing its consumption; excess demand for foodgrains is generated and prices rise, bringing down the real value of the money supply until it equals the real value desired. A reversed chain of events (lowering prices) will occur if the two sectors together demand greater real money balances than are available at existing price levels. Thus the requirement in equilibrium of zero saving in each sector implies a unique distribution of money balances and price level, given the exogenous variables, foodgrain production, taxes, and total money supply.<sup>12</sup>

Let us now see the results of a suddenly-reduced output of foodgrains. The non-agricultural sector is initially unaffected, having the same real income (taxes do not vary) and real wealth; hence its demand for foodgrains is not altered. The agriculturists' real wealth is unaffected by the crop failure, but their real income declines, grain for grain, with their production. They will retrench their consumption (for their marginal propensity to consume is positive), but their own demand for self-produced foodgrains will not be reduced as much as their output (for their marginal propensity to consume is less than one). The amount of foodgrains supplied to the non-agricultural sector will be smaller while the demand from that sector is unchanged—hence prices will be bid up.

Were this reduced production to continue, a new equilibrium would eventually be achieved. The price level would be higher and the real income of the non-agricultural sector lower (for taxes are unchanged). There might also be changes in agriculturists' real after-tax income or their nominal money balances.<sup>13</sup> For every configuration of the three exogenous variables (foodgrain output, tax level, and money supply), there is a unique equilibrium level of prices and share of money balances in each sector. This new equilibrium would, in time, be attained.

More interesting, however, is the behaviour of the economy if foodgrain production returned to normal after a year of crop failure. Provided that the tax levels and the money supply were unchanged, the previous equilibrium would eventually reassert itself. Prices, which had risen in the year of crop failure, would necessarily fall again. The movement toward the higher-price equilibrium which was relevant to the reduced-food output

---

<sup>12</sup>. Technically, there are two equations to determine two variables. See the Mathematical Appendix.

<sup>13</sup>. See Mathematical Appendix.

would be halted by the reappearance of normal crops and the economy would begin to return to its previous equilibrium.

Monetary policy is, in such an economy, effective in the sense that an unchanged money supply is necessary and sufficient to insure that temporary rises of prices are ultimately reversed (if the government budget remains unchanged throughout and food production returns to "normal"). If the money supply is permitted to expand, however, a higher level of prices will be permanently tenable.

There is nothing new in all this; it is traditional monetary theory in a somewhat untraditional guise. The results completely conform to our expectations. But this exercise is not without value, for it will be seen in the next section that this same economy will function in vastly different fashion if one small alteration (in the direction of realism) is made in its structure.

### SECTION III

In this section, it is assumed that some part of the agricultural sector's real wealth balances consist of hoarded foodgrains, the rest being real money holdings.<sup>14</sup> Otherwise, the economy is assumed to be identical to that discussed in the previous section.<sup>15</sup>

The difficult question that immediately arises with the introduction of a second kind of wealth is what determines the portion of total wealth kept in each form in the agricultural sector. It is especially difficult because there is no economic difference between the two forms.<sup>16</sup> In fact, not only is little known about the size of rural foodgrain wealth holdings in predominately agricultural economies, but almost nothing is known about what causes changes (and by how much) in the relative proportions of foodgrain stocks and money in rural wealth balances. Since this ignorance can only be dis-

---

<sup>14</sup>. Alternatively we could assume that foodgrain balances comprise part of the non-agricultural sector's wealth balances. In countries where much rural wealth is owned by non-cultivators (*i.e.*, landlords, money-lenders, etc.), we must recognize that the non-agricultural sector (as here defined) is likely also to hold foodgrain balances. The conclusions of this section are not fundamentally affected by the choice of the sector which is assumed to hoard foodgrains.

<sup>15</sup>. More accurately, identical consumption schedules, foodgrain output, tax and transfer rates, and money supply are assumed. The equilibrium price level will clearly be higher since the total real wealth balances of the economy are larger by the amount of hoarded foodgrains. In the effort to achieve an optimal relation between consumption and real wealth, the two sectors will bid up the price level until the total real wealth balances are the same in equilibrium as in the equilibrium of the previous section. See the Mathematical Appendix.

<sup>16</sup>. Unless an expectation of price changes exists, in which case all wealth would be held as money if price falls were expected and all as foodgrains if rises were expected. We assume no conscious speculation along these lines.

pelled by empirical work, we will approach it warily; we assume that a certain fraction of wealth is kept in foodstocks, for reasons unknown, and we will introduce assumptions about changes in this fraction as necessary.

Let us begin in equilibrium, as in Section II, and analyse the effects of a short-lived decline in foodgrain output. Initially demand by the non-agricultural sector for foodgrains is unaltered since neither its real income nor its real wealth is affected. The real income of agriculturalists does fall, however, and so also their self-consumption (this latter by less). This decline in marketed food, together with an initially unchanged non-agricultural demand, will drive prices up. The process is completely identical to that described in Section II.

What happens if foodgrain output later returns to its previous higher level? The analysis of Section II showed that, with money and taxes unchanged, efforts to restore the desired higher real money balances would bid prices down to their earlier equilibrium. Will that still be the case? It certainly *could* be—the same levels of foodgrain stocks and real money balances might be re-established, and concomitantly the same price level as previously co-existed with that foodgrain output. But there is a second possibility: the agricultural sector may restore its real wealth balances merely by stockpiling its self-produced foodgrains. Farmers may just as easily re-attain their earlier real wealth position in this fashion, though it will mean that a larger proportion of their wealth will now be in foodgrains.

It may not seem reasonable at first glance that farmers should desire a different composition of wealth now than they did in exactly the same situation earlier (*i.e.*, before their output fell). But the situation is *not* exactly the same. Earlier they *held* a certain composition of money and foodgrains; now they must *re-establish* that composition and must *push down* the price of their merchandise to do it. Of course, the farmers do not know beforehand that they will drive down prices, but they will notice that prices are falling as soon as they try. It is very likely that they will then cease to market such large amounts and will become satisfied with holding a larger fraction of foodgrain wealth.

The rural sectors of underdeveloped economies generally become ever more monetized, as time passes and growth occurs, not only in their transactions but also in their willingness to hold money as wealth. Thus, the fraction of total real wealth that is held in the form of foodgrain stocks declines chronologically in the agricultural sector. Slowly but inevitably the monetization of rural wealth proceeds. This process cannot be hurried—if a government pushes too much money into the economy, relying on a *rapidly* increased rural willingness to substitute money for other wealth-forms, it will learn

from the ensuing inflation that this process of monetization cannot be hastily accelerated.

This process may not be forced, but it may be at least temporarily reversed. Farmers may always be willing, if circumstances warrant, to hold a *smaller* fraction of their wealth as money. The inexorable monetization of the countryside cannot be halted but it can be temporarily retarded. When a farmer has only recently begun to hold as large a portion of his wealth in money as he presently does, the desire cannot yet be too deeply implanted; and if, to restore that portion in money, he must sell his crop at declining prices, he may quite readily "regress" to a larger fraction of foodgrain wealth.

If this in fact occurs, the implications for monetary policy are enormous. Its entire basis disappears once the farmer is able and willing to produce a money substitute. Consider now the price implications of a temporary crop failure. When foodgrain production falls, prices rise; when production recovers, the real wealth balances of the agricultural sector become inadequate. But the farmer merely stockpiles foodgrains until his wealth holdings are adequate. As long as the price level does not fall, the real wealth balances of the non-agricultural sector are adequate, since the recovery of foodgrain production does not affect its real income (unless prices fall).

There are, therefore, two extreme possibilities concerning prices when foodgrain output recovers from a temporary fall (always assuming unchanged tax-and-transfers and money supply). The first is that there will be no change in rural foodgrain hoards and prices will decline to their previous level (as in Section II, when no foodgrain hoards were held). The second is that any inadequacy of rural real wealth balances will be entirely satisfied by accumulation of foodgrain hoards with no decline at all in prices. There is a strong likelihood that reality will be more closely described by the latter.

If the government persists in its belief that the rise in foodgrain prices is temporary, since it was occasioned by a temporary fall in output, its error will only gradually become apparent. For prices will not decline. While pursued, however, a policy of "monetary restriction" (*i.e.*, no change in taxes or money supply) will have two serious effects upon the economy:

- (1) Foodgrains will be diverted from consumption to hoards.
- (2) The standard-of-living of the non-agricultural sector is lowered, relative to the agricultural sector (since its money income, the transfer, is unchanged in the face of higher prices).



Monetary authorities need not accept this conclusion of the crop failure and "temporary" price rise. If, instead, they accept the price rise as inevitable and increase proportionately (to the price rise) the money supply and the tax level, neither of the two effects cited above will occur. It will be possible for farmers to replenish their money wealth *without* forcing down prices, and there is no reason why they should not be willing to do so. None of the real variables of the system (*i.e.*, consumption, real income, *etc.*) are changed, and this is a much more sensible goal than that *some* of the monetary variables (*i.e.*, money supply, taxes, and non-agricultural money income) remain unchanged.

#### SECTION IV

While the economies described in Sections II and III are nowhere to be found in this world, the lesson they offer is quite applicable. Certainly, if one accepts that farmers will react as suggested in Section III, the efficacy of monetary restriction to reverse "temporary" price rises is in doubt.

If the price level cannot be driven back down, it may be advisable to accept the rise and to ensure that the real variables of the system are not altered (or reduced). This requires money supply expansion and higher government budgets.

To blame the price rise on the larger money supply in this situation would be seriously to err, chronologically as well as causatively—*ante hoc*, *ergo propter hoc*. The higher price level can, and will, maintain itself whether or not the money supply is expanded. If the government is to keep the price level from permanently rising, it must take action to prevent temporary declines in foodgrain production. Once crops fail, a permanent price increase may be inevitable.

The application of monetary restriction in such situations, may be both liable to failure and retarding of the long-run objective of the central bank, to achieve rapid and efficient monetization of the rural economy. This latter purpose may be far more important in underdeveloped economies; it is essential to create the kind of economy where traditional policy techniques can succeed before employing these techniques. First "to maturity must crawl that child in whom the old equations are reversed for that is cause which was effect before."

## Mathematical Appendix

The following symbols will be used in this appendix:

- C, consumption of foodgrains
- M, money supply
- T, tax on agricultural sector (equals transfer to non-agricultural sector)
- p, price of foodgrains
- X, production of foodgrains
- S, stockpiles of foodgrains (assumed zero in Section II).

The subscript A means that the variable refers to the agricultural sector; the subscript B to the non-agricultural sector. A dot over a variable. (e.g.,  $\dot{M}_A$ ) refers to the rate of change of the variable at a moment of time.

### TO SECTION II

Consumption in each sector is assumed a function of its real income and real wealth (money) balances. Hence,

$$(1) \quad C_A = A \left[ X - \frac{T}{p}, \frac{M_A}{p} \right]$$

$$(2) \quad C_B = B \left[ \frac{T}{p}, \frac{M_B}{p} \right]$$

where A and B represent functions. Recalling that the total money supply is given and constant, we have

$$(3) \quad M_B = M - M_A$$

and

$$(4) \quad \dot{M}_B = -\dot{M}_A$$

Let us assume, for simplicity, that the consumption functions may be approximated (in relevant ranges) by linear relations:

$$(5) \quad C_A = a_0 + a_1 \left( X - \frac{T}{p} \right) + a_2 \frac{M_A}{p}$$

$$(6) \quad C_B = b_0 + b_1 \frac{T}{p} + b_2 \left( M - \frac{M_A}{p} \right)$$

where the parameters are within the following ranges:

$$a_0, b_0 \geq 0; 0 < a_1, b_1 < 1; \text{ and } a_2, b_2 > 0.$$

Finally, at all times, the total consumption of the two sectors must be equal to foodgrain output (since, for the present, none may be hoarded):

$$(7) \quad X = C_A + C_B$$

and the difference between what the agricultural sector receives from sales and what it is taxed is the net addition to its money balances<sup>1</sup>:

$$(8) \quad \dot{M}_A = pC_B - T$$

Substitution of (7) and (8) into (5) and (6) permit the elimination of  $C_A$  and  $C_B$ :

$$(10) \quad X - \frac{\dot{M}_A}{p} - \frac{T}{p} = a_0 + a_1 \left( X - \frac{T}{p} \right) + a_2 \frac{M_A}{p}$$

$$(11) \quad \frac{\dot{M}_A}{p} + \frac{T}{p} = b_0 + b_1 \frac{T}{p} + b_2 \left( \frac{M - M_A}{p} \right)$$

Multiplying each by  $p$  and collecting terms:

$$(12) \quad p [(1-a_1)X - a_0] - \dot{M}_A - (1-a_1)T - a_2M_A = 0$$

$$(13) \quad p b_0 - \dot{M}_A - (1-b_1)T + b_2M - b_2M_A = 0$$

Since  $X$ ,  $T$ , and  $M$  are exogenous, these two equations determine the endogenous variables,  $p$  and  $M_A$  (and hence, by (3),  $M_B$ ).

<sup>1</sup> This is also true of the non-agricultural sector;

(9)  $\dot{M}^B = T - pC_B$   
but this follows from (4) and (8).

Let us first examine the equilibrium situation implicit in (12) and (13). Let  $\dot{M}_A$  be zero (as it must in static equilibrium) and solve explicitly for  $p$  and  $M_A$ . The results are sufficiently complex that we will write them out on the assumption that  $a_0$  and  $b_0$  are zero; this further loss of generality does not, I believe, greatly affect the conclusions. The equilibrium values are:<sup>2</sup>

$$(14) \quad M_A = M - \frac{1-b_1}{b_2} T = \frac{1-a_1}{a_2} (pX - T); \text{ also } M_B = \frac{1-b_1}{b_2} T$$

$$(15) \quad pX = \frac{a_2}{1-a_1} M + \left[ 1 - \frac{a_2(1-b_1)}{b_2(1-a_1)} \right] T$$

It is worth noting that, in such a simple economy, the quantity theory of money is valid—each sector holds an amount of money balances proportional to its money income. It should not surprise anyone that the quantity theory does not appear in its usual form in equation (15), for it has long been known that redistributions between sectors of the economy having different velocities (through each is constant) will alter the velocity of the economy as a whole.<sup>3</sup>

Finally, we should examine the dynamic part of the system to ascertain that this equilibrium is stable. The differential equation (13), letting  $b_0=0$ , may be solved for  $M_A$  in terms of the initial value of  $M_A$  ( $M_A^0$ ) and the equilibrium value of  $M_A$  ( $M_A^E = M - \frac{1-b_1}{b_2} T$ , by equation (14)):

$$(17) \quad M_A = \left[ M_A^0 - M_A^E \right] e^{-b_2 t} + M_A^E$$

Since  $b_2$  is assumed positive,  $M_A$  will inexorably approach its equilibrium value ( $M_A^E$ ) despite any initial discrepancy ( $M_A^0 - M_A^E$ ). Furthermore, we can use (12) and (13) to eliminate  $\dot{M}_A$ , (17) to eliminate  $M_A$ , and (14) to eliminate  $M_B^E$  to find:

---

<sup>2</sup>. For all variables to be non-negative in equilibrium, it is necessary (as concerns  $M_A$ ) and sufficient (as concerns both  $M_A$  and  $p$ ) that

$$(16) \quad T \quad \frac{b_2}{1-b_1} M$$

If this is not so, all the money in the economy cannot prevent the non-agriculturists from trying to save and no equilibrium is possible.

<sup>3</sup>. If the velocities of the two sectors,  $\frac{a_2}{1-a_1}$  and  $\frac{b_2}{1-b_1}$  respectively, are equal, the term involving  $T$  in (15) disappears.

$$(18) \quad pX = \frac{a_2}{1-a_1} M + \left[ 1 - \frac{a_2(1-b_1)}{b_2(1-a_1)} \right] T + \frac{a_2-b^2}{1-a_1} \left[ M_A^O - M_A^E \right] e^{-b_2 t}$$

Hence, if the system is always in monetary equilibrium ( $M_A^O = M_A^E$ ), the total value of production ( $pX$ ) will never be altered even by changes in  $X$ . Food-grain output may fall, then prices will rise; if  $X$  later returns to its original value, so will  $p$ , provided only that the government does not alter  $M$  or  $T$ .

### TO SECTION III

Once foodgrain hoards are introduced into the agricultural sector, equations (5), (6), (7), and (8) become:

$$(19) \quad C_A = a_1 \left( X - \frac{T}{p} \right) + a_2 \left( \frac{M_A}{p} + S_A \right)$$

$$(20) \quad C_B = b_1 \frac{T}{p} + b_2 \left( \frac{M - M_A}{p} \right)$$

$$(21) \quad X = C_A + C_B + \dot{S}_A$$

$$(22) \quad \dot{M}_A = pC_B - T$$

where  $a_0$  and  $b_0$  are again assumed zero, and  $S_A$  is written for agricultural foodgrain stocks. Again, using (21) and (22) to eliminate  $C_A$  and  $C_B$ , we find:

$$(23) \quad M_A = M - \frac{1-b_1}{b_2} T + \left[ M_A^O - M_A^E \right] e^{-b_2 t}$$

$$(24) \quad p \left[ X - \frac{1}{1-a_1} \dot{S}_A - \frac{a_2}{1-a_1} S_A \right] = \frac{a_2}{1-a_1} M + \left[ 1 - \frac{a_2(1-b_1)}{b_2(1-a_1)} \right] T + \frac{a_2-b_2}{1-a_1} \left[ M_A^O - M_A^E \right] e^{-b_2 t}$$

Equations (23) and (24) are analogous, where agricultural foodgrain hoards exist, to equations (17) and (18), where the only wealth form is money. Again, it should be noted that any disturbance from equilibrium tends to disappear since  $b_2$  is positive.

In equilibrium (*i.e.*, when  $M_A^O = M_A^E$ ), the righthand sides of each of (23) and (24) are identical with those of (17) and (18). Thus, whether agriculturists hold foodgrain balances or not, the distribution of money balances between the two sectors will be the *same*. The *real* money wealth of each

sector will, however, be lower (when foodgrain stocks are held) if

$$(25) \quad \dot{S}_A + a_2 S_A > 0$$

The reason is as follows. If (25) holds, the term in brackets on the left-hand side of (24) will be less than  $X$ ; hence, the right-hand side being unaffected by  $S_A$ ,  $p$  will be higher. Thus, the possibility of positive values of  $S_A$  means, if (25) holds, a higher level of prices in the economy. In fact, in equilibrium (where  $\dot{S}_A = 0$ ), the total real wealth holdings of the economy will be, from equation (24):

$$(26) \quad \frac{M}{p} + S_A = \frac{1-a_1}{a_2} X - \left[ \frac{1-a_1}{a_2} - \frac{1-b_1}{b_2} \right] \frac{T}{p}$$

This is *exactly* the same, if  $\frac{1-a_1}{a_2} = \frac{1-b_1}{b_2}$ , as the total real wealth holdings, in equilibrium, in Section II (derived from equation (18)).<sup>4</sup>

Since, in Section II,  $S_A = 0$ ,  $p$  must be higher in the economy when foodgrain stocks are held.

The critical point about (24) is its indeterminacy. To say anything about  $p$ , given  $X$ ,  $M$ , and  $T$ , we *must know something* about the behaviour of  $S_A$ . Without such knowledge, one cannot know whether monetary policy will be effective.

It is easily verified that, if  $S_A$  is *always* a fixed fraction of total wealth balances in the agricultural sector, then monetary policy is effective (in the sense defined earlier). In fact, such a portfolio equation,

$$(27) \quad S_A = c \frac{M_A}{p}$$

is implicit in the work of Section II, but with  $c$  there set equal to zero. The possibility discussed in Section III is that at any moment of time, the desired portfolio relation of the agricultural sector is

$$(28) \quad S_A > c \frac{M_A}{p}$$

<sup>4</sup> If  $\frac{1-a_1}{a_2} \neq \frac{1-b_1}{b_2}$ , they will differ at least slightly because of the different values of  $p$ .

Then, if (in equilibrium with (27) holding true) the money supply is increased, the analysis of Section II applies and  $p$  rises. If, however,  $p$  rises because  $X$  falls, then a return of  $X$  to its previous level means any one of three things may happen:

(1)  $p$  returns to its previous level (and (27) is re-established with no change in  $S_A$ ).

or (2)  $S_A$  rises,  $p$  remains at its new higher level (and (27) is not re-established).

or (3)  $M$  (and hence  $M_A$ ) rises (and (27) is re-established with no change in  $S_A$ ).

The text (Section III) suggests that possibility (1) may be unlikely to occur in which case the government must choose between (2) and (3). The third possibility is clearly preferable.

This choice may also be seen through the equilibrium equations of the system described by equations (19) through (22):

$$(29) \quad M_A = M - \frac{1-b_1}{b_2} T$$

$$(30) \quad p \left[ X - \frac{a_2}{1-a_1} S_A \right] = \frac{a_2}{1-a_1} M + \left[ 1 - \frac{a_2(1-b_1)}{b_2(1-a_1)} \right] T$$

$$(31) \quad C_A = X - \frac{T}{p}$$

$$(32) \quad C_B = \frac{T}{p}$$

If  $p$  rises (because  $X$  falls temporarily) and  $X$ ,  $M$ , and  $T$  remain unchanged (as they will after crops return to normal if  $M$  and  $T$  are not permitted to rise), then  $S_A$  must rise (if  $p$  does not fall to its original level) and  $C_B$  become permanently lower than before (and  $C_A$  concomitantly higher). If, however, the government permits a rise in  $M$  and  $T$  proportionate to the rise in  $p$ , no increase in  $S_A$  need occur and no change in  $C_A$  or  $C_B$  need take place. If  $p$  rises (because of a temporary fall in  $X$ ) and the government wishes no change in the *real* variables of the system, *one way* to achieve this is to raise  $M$  and  $T$  proportionately. It may be the only way to prevent a rise in the equilibrium amount of  $S_A$  and  $C_A$  and a fall in that of  $C_B$  (with an additional temporary loss of consumption while the larger  $S_A$  is being accumulated).