ON A DESTABILIZING EFFECT OF COMMODITY MARKET INTERVENTION

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INTRODUCTION

SINCE the beginning of the 1970s, the international economic system has experienced several serious problems that need to be resolved. One of the most pressing issues, I believe, is the primary commodity problem, whose arena has mainly been the United Nations Conference on Trade and Development (UNCTAD). The Integrated Programme for Commodities (IPC) may be the first step to develop a new system. While we do not have enough knowledge to determine the possibilities of success of the program, examination of the function of the international commodity agreement (hereafter ICA) may be an important step in finding avenues of mutual interest to both the North and South.

Although a vast literature analyzing the workings of the ICA exists,[1] little explores problems from a macro-open-economic point of view, in particular with relation to asset market behavior. The purpose of this paper, therefore, is to meet the "excess demand" for studies on broader-based effects of intervention through buffer stock operation. Fortunately we now have a fairly suitable analytical tool to accomplish this, that is, the method of Carl Van Duyne [11]. While his own work did not directly deal with this kind of intervention, application of his theoretical framework in the analysis of the effects of such operations has proven fruitful.

This paper is divided into two parts: In Section I, a modified Van Duyne model is presented and in Section II the model is used to ascertain the intervening effects from macro-open-economic point of view.

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[1] We can divide the literature into four categories. The first asserts that the ICA may be the product of "political will," not of economic rationality. See, for example, L. N. Rangarajan [8]. In the second, arguments highlight the aspects of "negative" negation of the ICA as in H. G. Johnson [3] and R. Komiya and A. Amano [4]. Essential points of their arguments are discussed in Section II. The third emphasizes the aspects of "positive" negation. See, for example, H. Sakai [10]. Finally, the welfare effects of price stabilization are detailed in B. F. Massell [6], H. Sakai [10], and others. Readers should also see K. Hemmi [2] regarding the ICA in general.

I. THE MODEL

The model in this paper deals with two countries, two goods, and three assets. One country perfectly specializes in primary commodity production and the other in manufactured good production, with full employment prevailing everywhere. We assume that the home country produces the manufactured good and the foreign country the primary commodity. We also assume in this model the manufactured good is a fix-price good and the primary commodity is a flex-price good in the Hicksian sense.

Commodity stocks, domestic money, and foreign exchange are the three assets which are imperfect substitutes in asset holders' portfolios. Only the home country has asset markets and asset holders. The nominal yield on domestic money and foreign currency as well as the storing cost of commodity stocks are all assumed to be zero.

A. *Asset Markets*

We consider first the working of asset markets. The equilibrium system of asset markets is represented with the following equations:

$$F=f(\dot{\pi}^e,\ \dot{p}^e)\cdot W\,, \tag{1}$$

$$pC=c(\dot{\pi}^e,\ \dot{p}^e)\cdot \pi W\,, \tag{2}$$

$$M=m(\dot{\pi}^e,\ \dot{p}^e)\cdot \pi W\,, \tag{3}$$

$$W=F+\frac{p}{\pi}C+\frac{1}{\pi}M\,, \tag{4}$$

$$\pi=\frac{\dot{\pi}^e}{\theta}+\bar{\pi}\,,\quad \theta<0\,, \tag{5}$$

$$p=\frac{\dot{p}^e}{\delta}+\bar{p}\,,\quad \delta<0\,, \tag{6}$$

$$f+c+m=1\,, \tag{7}$$

where

F : domestic money,
C : commodity stocks,
M : foreign currency,
W : nominal value of net wealth,
π : spot exchange rate expressed as the foreign currency price of foreign exchange,
p : the spot foreign currency price of primary commodity,
$\dot{\pi}^e$: the expected rate of change in π,
$\dot{p}^e$: the expected rate of change in p,
f, c, m : the fraction of aggregate portfolios held in each of the three assets and their functional forms, and
θ, δ : the adjustment rate.

Participants in the markets for domestic money and the primary commodity are assumed to know the long-run equilibrium prices, i.e., $\bar{\pi}$ and $\bar{p}$. With respect to f, c, and m, the following properties are assumed to hold:

$$\frac{\partial f}{\partial \dot{\pi}^e}=f_1>0\,, \quad \frac{\partial f}{\partial \dot{p}^e}=f_2<0\,,$$

$$\frac{\partial c}{\partial \dot{\pi}^e}=c_1<0\,, \quad \frac{\partial c}{\partial \dot{p}^e}=c_2>0\,,$$

$$\frac{\partial m}{\partial \dot{\pi}^e}=m_1<0\,, \quad \frac{\partial m}{\partial \dot{p}^e}=m_2<0\,.$$

In equations (1), (2), and (3), asset holders in the aggregate are constrained by net wealth at any moment in time, so the sum of responses of all assets to changes in $\dot{\pi}^e$ and $\dot{p}^e$ must be zero:

$$f_1+c_1+m_1=0\,, \tag{8}$$

$$f_2+c_2+m_2=0\,. \tag{9}$$

In what follows, we also assume for convenience that asset holders face just the portfolio choice between the commodity and domestic money, with M and m being constant and very small. In the following discussion, we then drop equation (3). Since m is not zero but positive and very small, instead of equations (7), (8), and (9), we have[2]

$$f+c=1\,, \tag{7'}$$

$$f_1+c_1>0\,, \tag{8'}$$

$$f_2+c_2>0\,. \tag{9'}$$

This system works as follows. We first assume a disturbance concerning domestic money, whereby the existence of a divergence from the initial long-run equilibriums is reflected in the differences between the desired and existing levels of the two assets, with domestic money being in excess and the primary commodity short. Asset holders then expect $\dot{\pi}^e$ and $\dot{p}^e$ on the basis of correctly calculated $\bar{\pi}$ and $\bar{p}$. (In this model, $\dot{\pi}^e$ and $\dot{p}^e$ are assumed to be given.) We assume asset holders' behavior such that when the difference between the desired and existing levels of C is negative, i.e., the desired level is above the existing level, they expect that holding more C will give rise to capital loss since they know that market prices will settle at the level of $\bar{\pi}$ and $\bar{p}$ respectively at the time when adjustment in real terms is completed despite a sharp initial rise in market prices. Therefore, when the difference dC is negative, $\dot{p}^e$ becomes negative. This assumption guarantees that p will not become infinitely large. Similarly, $\dot{\pi}^e$ becomes positive when there are excess holdings.

Through the above-mentioned process, f in equation (1) becomes larger and c in equation (2) becomes smaller. Prices change to the level described by the right-hand side of equations (5) and (6). Thus the values of endogenous vari-

[2] Obviously, (7'), (8'), and (9') are not consistent. But loss of rigor seems small compared to the increase in clarity and ease of application.

ables, π, p, f, c, F, C, and W are determined by equations (1) through (7'), excluding equation (3) and including one redundant equation.

To examine the effects on p and π of differences of C and F from the long-run equilibrium level, we assume that equilibrium conditions are satisfied initially, and prices are set equal to unity. We derive the effects by totally differentiating equations (1) and (2). (The terms $d\pi$, dp, dF, and dC below should be interpreted as deviations from prices and stocks that will be obtained in the long-run equilibrium.)

By totally differentiating equations (1), (4), (5), and (6), we obtain

$$dF = f dW + W\cdot(f_1 d\dot{\pi}^e + f_2 d\dot{p}^e)\,,$$
$$dW = dF + cW dp - cW d\pi + dC\,,$$
$$d\dot{\pi}^e = \theta d\pi\,,$$
$$d\dot{p}^e = \delta dp\,.$$

With these derivatives and (7'), we have

$$W\{(fc-f_1\theta)d\pi + (-fc-f_2\delta)dp\} = -cdF + fdC\,. \tag{10}$$

Similarly, by totally differentiating equation (2) and substituting the derivatives into it, we obtain

$$W\{(-fc-c_1\theta)d\pi + (fc-c_2\delta)dp\} = cdF - fdC\,. \tag{11}$$

Thus, we have

$$W\begin{bmatrix} fc-f_1\theta & -fc-f_2\delta \\ -fc-c_1\theta & fc-c_2\delta \end{bmatrix}\begin{bmatrix} d\pi \\ dp \end{bmatrix} = \begin{bmatrix} -c & f \\ c & -f \end{bmatrix}\begin{bmatrix} dF \\ dC \end{bmatrix}, \tag{12}$$

or

$$\tilde{D}\begin{bmatrix} d\pi \\ dp \end{bmatrix} = \tilde{B}\begin{bmatrix} dF \\ dC \end{bmatrix}. \tag{13}$$

The inverse matrix of D is expressed as

$$\tilde{D}^{-1} = \frac{W}{\Delta}\begin{bmatrix} fc-c_2\delta & fc+f_2\delta \\ fc+c_1\theta & fc-f_1\theta \end{bmatrix},$$

where

$$\Delta = (fc-f_1\theta)(fc-c_2\delta) - (-fc-f_2\delta)(-fc-c_1\theta)\,.$$

With the help of equations (5) through (9'), Δ is found to be unambiguously positive.

Next is to determine the signs of the elements of the following coefficient matrix A,

$$\begin{bmatrix} d\pi \\ dp \end{bmatrix} = \tilde{D}^{-1}\tilde{B}\begin{bmatrix} dF \\ dC \end{bmatrix} = \tilde{A}\begin{bmatrix} dF \\ dC \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}\begin{bmatrix} dF \\ dC \end{bmatrix}. \tag{14}$$

Excluding W and Δ for convenience, the element a_{ij} is expressed as

$$a_{11} = (fc-c_2\delta)(-c) + (fc+f_2\delta)c\,,$$
$$= \delta\{c(f_2+c_2)\}\,,$$

$$a_{22}=(fc+c_1\theta)f+(fc-f_1\theta)(-f)\,,$$
$$=\theta\{f(f_1+c_1)\}\,,$$
$$a_{12}=(fc-c_2\delta)f+(fc+f_2\delta)(-f)\,,$$
$$=-\delta\{f(f_2+c_2)\}\,,$$
$$a_{21}=(fc+c_1\theta)(-c)+(fc-f_1\theta)c\,,$$
$$=-\theta\{c(f_1+c_1)\}\,.$$

Then we have the following unambiguous signs of a_{ij}: a_{11} and a_{22} are negative, and a_{12} and a_{21} are positive.

These signs obtained above state the effects on the terms of trade of price changes necessary to adjust the disequilibriums caused by the initial shock in asset markets in the home country. As assumed the home currency price of the manufactured good in the home country is fixed in the Hicksian sense, but the foreign currency price of the manufactured good varies directly with the exchange rate. Let p_m and p_m^* denote the home currency price and the foreign currency price, respectively. If units are chosen so that $p_m=1$, then $p_m^*=\pi$. Thus, the terms of trade to the foreign country is expressed as p/π, since $p/p_m^*=p/\pi$. On the basis of the previous discussion, it can be easily shown that

$$\frac{d(p/\pi)}{dF}=\frac{\partial(p/\pi)}{\partial p}\cdot\frac{dp}{dF}+\frac{\partial(p/\pi)}{\partial\pi}\cdot\frac{d\pi}{dF}\,.$$

Because $p=\pi=1$ at the initial equilibrium,

$$\frac{d(p/\pi)}{dF}=\frac{dp}{dF}-\frac{d\pi}{dF}=a_{21}-a_{11}>0\,.$$

Similarly,

$$\frac{d(p/\pi)}{dC}=\frac{dp}{dC}-\frac{d\pi}{dC}=a_{22}-a_{12}<0\,.$$

These imply that the terms of trade with the foreign country move directly with changes in domestic money holdings and inversely with changes in commodity stocks.

B. *Goods Markets*

Through such effects on the terms of trade, stocks equilibrated in asset markets in monetary terms can be equilibrated in real terms through adjustments in goods markets. The assumptions concerning the functioning of goods markets are basically similar to those of Van Duyne [11] with several modifications essential to this paper.

With the assumptions mentioned previously—perfect specialization and full employment—production of each good is fixed. Further, we also assume that the demand for each good in each country is a function of degree zero in nominal prices, nominal income, and nominal wealth.

The goods market is determined with the following equations:

$$\dot{C}=\bar{S}-X\left(\frac{p}{\pi},\,W\right)\,, \tag{15}$$

$$\dot{F}=\frac{p}{\pi}X-D^m(p,\ \pi,\ Y)\,, \tag{16}$$

$$Y=p\bar{S}\,, \tag{17}$$

where

X : imports,
$\bar{S}$: aggregate production of primary commodity,
D^m: foreign demand for manufactured good,
Y : national income of foreign country.

With regard to X and D^m, the following properties hold:

$$\frac{\partial X}{\partial(p/\pi)}=X_1<0\,,\quad \frac{\partial X}{\partial W}=X_2>0\,,$$

$$\frac{\partial D^m}{\partial p}=D^m{}_1>0\,,\quad \frac{\partial D^m}{\partial \pi}=D^m{}_2<0\,,\ \frac{\partial D^m}{\partial Y}=D^m{}_3>0\,.$$

Equation (15) implies that the rate at which commodity stocks are accumulated equals the excess supply of the commodity. Equation (16) refers to the current account surplus or deficit for the foreign country. The dynamic adjustment process can be analyzed in the same manner as does Van Duyne [11], that is, by taking a Taylor's series expansion in the neighborhood of the long-run equilibrium.

From equations (15) and (16), we obtain

$$\begin{bmatrix}\dot{F}\\ \dot{C}\end{bmatrix}=\begin{bmatrix}-X-X_1-X_2C-D^m{}_2 & X+X_1+X_2C-D^m{}_1-\bar{S}D^m{}_3\\ X_1+X_2C & -X_1-X_2C\end{bmatrix}\begin{bmatrix}d\pi\\ dp\end{bmatrix}$$
$$+\begin{bmatrix}X_2 & X_2\\ -X_2 & -X_2\end{bmatrix}\begin{bmatrix}dF\\ dC\end{bmatrix}, \tag{18}$$

or

$$\begin{bmatrix}\dot{F}\\ \dot{C}\end{bmatrix}=\begin{bmatrix}p_{11} & p_{12}\\ p_{21} & p_{22}\end{bmatrix}\begin{bmatrix}d\pi\\ dp\end{bmatrix}\begin{bmatrix}w_{11} & w_{12}\\ w_{21} & w_{22}\end{bmatrix}\begin{bmatrix}dF\\ dC\end{bmatrix}=\tilde{P}\begin{bmatrix}d\pi\\ dp\end{bmatrix}+\tilde{W}\begin{bmatrix}dF\\ dC\end{bmatrix}. \tag{18'}$$

$\tilde{P}$ represents the price effects and $\tilde{W}$ the direct wealth effects of changes in asset stocks.

Substituting equation (14) into equation (18'), we obtain

$$\begin{bmatrix}\dot{F}\\ \dot{C}\end{bmatrix}=\tilde{P}\tilde{A}\begin{bmatrix}dF\\ dC\end{bmatrix}+\tilde{W}\begin{bmatrix}dF\\ dC\end{bmatrix}$$
$$=\begin{bmatrix}p_{11}a_{11}+p_{12}a_{21} & p_{11}a_{12}+p_{12}a_{22}\\ p_{21}a_{11}+p_{22}a_{21} & p_{21}a_{12}+p_{22}a_{22}\end{bmatrix}\begin{bmatrix}dF\\ dC\end{bmatrix}+\begin{bmatrix}w_{11} & w_{12}\\ w_{21} & w_{22}\end{bmatrix}\begin{bmatrix}dF\\ dC\end{bmatrix}$$
$$=\begin{bmatrix}z_{11} & z_{12}\\ z_{21} & z_{22}\end{bmatrix}\begin{bmatrix}dF\\ dC\end{bmatrix}. \tag{19}$$

To identify the signs of the element z_{ij}, we will examine the adjustment process. First, with the initial disturbance $dF>0$, the terms of trade for the foreign country improves. As the Marshall-Lerner condition indicates, improvement in terms of

trade for the foreign country makes the foreign country's trade account deficit deteriorate. The direct wealth effects work in the opposite direction, that is to say, a positive dF means that the demand for both goods increases because the level of existing stocks is above the desired level and this difference stimulates the demand. The increased demand for both goods in turn exacerbates the home country's current account deficit. As we assume that the price effects are more powerful than the direct wealth effects, the net effect on $\dot{F}$ of dF is negative and we have negative z_{11}.

Second, we study the process concerning z_{22}. The shortage of C makes the terms of trade for the foreign country improve, which implies that the demand for primary commodity in the home country decreases, $\dot{C}>0$. The direct wealth effects make $\dot{C}$ negative because negative dC operates on the demand to be suppressed. With the two effects, z_{22} is negative.

Similarly, we derive the signs of z_{12} and z_{21}. With the Marshall-Lerner condition, we get the relation between dC and $\dot{F}$. The disequilibrium in commodity stocks changes the terms of trade which exacerbates the foreign country's trade account deficit, $\dot{F}<0$. It means that the sign of z_{12} is positive. The direct wealth effects also work to make it positive, because the demand suppression by negative dC increases the foreign country's trade account deficit.

With the assumption of the dominance of price effects, we get the net relation between dF and $\dot{C}$. The excess of F changes the relative price ratio and the demand for the primary commodity decreases, $\dot{C}>0$. It means that, from this point of view, the sign of z_{21} becomes positive. Although positive dF means that the demand for both goods increases due to the wealth effects and the resulting negative $\dot{C}$ implies a negative z_{21}, with the above-mentioned assumption the net effect is a positive z_{21}.

Therefore, with signs of elements z_{ij} established, we can say that the adjustment path moves toward stability since the disequilibriums caused by the initial disturbance ($dC<0$ and $dF>0$) are eliminated through the adjustment ($\dot{C}>0$ and $\dot{F}<0$).

Economic interpretation of the above stabilizing process is as follows. Negative $\dot{F}$ means that the foreign country's trade account deficit increases and the level of π also goes up. Thus the desired level of domestic money $\bar{F}$ rises much higher and the difference between the desired and the existing level dF shrinks toward zero despite expansion of the domestic money. Similarly, positive $\dot{C}$ indicates that in the goods market excess supply of the primary commodity comes into existence and the level of p falls. Through this process, the disequilibrium disappears in real terms. As long as the level of p is above the level of $\bar{p}$, with excess supply the price continues downward and the difference between the desired and the existing levels dC also shrinks toward zero.

II. EFFECTIVE INTERVENTION THROUGH THE INTERNATIONAL COMMODITY AGREEMENT

Price stabilization is one of the main purposes of the ICA concluded between

exporting and importing countries. As is well known, the ICA has several intervening techniques to carry out its purposes such as buffer stocks, multilateral contracts, and export restriction schemes.

The history of commodity trade as described by, for example, J.W.F. Rowe [9], reveals a long struggle with price instability and the efforts to find better techniques for price stabilization. One such scheme is ongoing in the worldwide experiment by the Integrated Programme for Commodities mainly through buffer stock operation. The latter is the focus of the rest of the paper. Under the terms of the stock scheme, participating countries contribute to the fund and so establish buffer stocks.[3] Through negotiations they decide the price range within which to keep market prices by means of buffer stock operation. The ICA releases the stock to lower the free market price when the latter rises above the ceiling level of the range, and purchases and accumulates the commodity to raise the free market price when it drops below the floor level of the range.

Before presenting our own discussion, we briefly review the arguments by H. G. Johnson [3] and R. Komiya and A. Amano [5] to clarify the scope and limit of this paper at this stage. H. G. Johnson states that "the crucial difficulty in all price-stabilization scheme is to forecast the long-run equilibrium price." And as we can assume a real improvement in forecasting accuracy, it "might be sufficient by itself to evoke stabilization of markets for primary products through speculation and arbitrage by private traders, without the need for international agreement" [3, p. 149]. We can find a similar assertion in [4, p. 230]. They state: "If short-run price fluctuation can be stabilized by means of buffer stock operation, the primary commodity producing countries would try to implement the operations by themselves without international agreements . . . . That is, if prices could be efficiently stabilized with the stock, the stock holding itself would be profitable so that not only an individual country but an individual private enterprise could try to do it. The reasons why they would not carry out such operations are high storing costs and difficulties to obtain an accurate price forecast and to procure necessary funds." The assertions cited above are very powerful, and as a matter of fact, without a solution to either the forecasting problem or the financial problem, further discussion is trivial. Likewise, if either one is satisfactorily eliminated, the problems regarding short-run price instability become tractable.

The model and the mechanism developed in the preceding section should be interpreted as a case where the first problem is successfully resolved. It was proved that the model has a stable solution under the assumptions mentioned, which means that we can leave the market to adjust itself. If so, a more realistic approach should concentrate on how to utilize information as efficiently as possible. Although we have no space to consider more on this interesting point, I wish to mention only one view expressed by L. B. Krause [5, p. 186] saying, "The manager should perform transactions in the forward as well as the spot market. Since funds or stocks on hand are not required for buying or selling

[3] We assume in this paper that the quantity of the stock is exogenously given. It is also assumed that the ICA uses the commodity as the intervening means.

forward, this will free the manager from the limitations of the existing stock in attempting to maintain the price within the range." According to him, the futures market works to mitigate forecasting and financing problems. Recently further interesting trials along this line have also been attempted.[4]

At any rate, we have several assertions of supporting and approximating the assumption of perfect foresight. The assumption that the manager of the ICA is given the ability to work substitutionally, not complementarily with the dynamic adjustment mechanism of markets[5] fits well in the scope of this paper, which is to examine macro-open-economic effects of "successful" intervention through buffer stock operation. In this case, however, the more efficiently the manager intervenes, the more inefficient the macro-open-economy becomes, which can be clearly shown with the help of the model developed in Section I. The assumptions about ICA intervention are summarized below.

(i) The manager has full knowledge about the long-run equilibrium prices.

(ii) The manager promptly intervenes as soon as the free market price goes out of the set price range.

With these two assumptions it is ensured that the agreement can intervene successfully to maintain prices within the range arranged at the level of the long-run equilibrium. We also assume:

(iii) The ICA cannot afford enough stocks to instantly eliminate the initial disequilibrium in real terms.

Therefore, the prompt intervention of the manager is just the beginning for this analysis. If the ICA can maintain sufficient stocks, the problem I attempt to analyze here will completely disappear.[6]

In addition to them, to make the discussion precise, we add another two assumptions:

(iv) The manager behaves as an individual asset holder in the asset market.

(v) The major reason for the price changes examined here is due to asset market behavior, that is, the shift from monetary to real assets, the dominant factor of which is disequilibrium in monetary assets.

The next step is to incorporate the above assumptions in the model prepared in the preceding section. The first assumption implies that the price range can be arranged at the level where the economy is in the long-run equilibrium. The second assumption states that, as soon as market prices move away from the level $\bar{p}$, the difference will be promptly eliminated by successful intervention. Based on this assumption we can say that p is always equated to $\bar{p}$ and that because this economy has three assets of which one is assumed to be negligible, the price of another asset would also be assumed to be equated to the long-run

[4] See, for example, [1] and [7].

[5] Without this assumption, assertions by H. G. Johnson, R. Komiya and A. Amano, etc. can hold.

[6] Problems may move to other dimension, but, of course they are still not resolved. One thing that is clear is that problems will move from more economic areas to less economic (or more political) ones.

equilibrium level, $\pi=\bar{\pi}$.[7] According to the third assumption, stock disequilibriums in real terms can be adjusted only through the function of the goods markets, and not through intervention.[8]

Therefore, if we incorporate buffer stock operation in the model by the first two assumptions we always have

$$\begin{cases} dp=0\,, \\ d\pi=0\,. \end{cases} \tag{20}$$

And by the third assumption, we have

$$\begin{cases} dC\neq 0\,, \\ dF\neq 0\,. \end{cases} \tag{21}$$

Furthermore, the fifth assumption gives us the following additive information. Since the domestic money disequilibrium dominates over the commodity stock disequilibrium through the adjustment, we have the following inequality throughout:[9]

$$dC<dF\,. \tag{22}$$

Therefore, intervention changes the adjustment path from the one described in equation (18′) or (19) to the following:

$$\begin{bmatrix} \dot{F} \\ \dot{C} \end{bmatrix}=\begin{bmatrix} w_{11} & w_{12} \\ w_{21} & w_{22} \end{bmatrix}\begin{bmatrix} dF \\ dC \end{bmatrix}. \tag{23}$$

Equation (23) is easily obtained by substituting equations (20) and (21) into (18′). In equation (23) the terms to express the price effects are excluded, and only the terms to express the direct wealth effects remain.

As described as the inequality (22), dF has a dominant effect over dC throughout the process. Thus, according to the adjustment mechanism expressed by equation (23) with inequality (22), we have $\dot{F}>0$ and $\dot{C}<0$. In the home country, the disequilibrium initially disturbed indicated the excess of F and the short of C. Therefore, in order to eliminate the disequilibrium and to move toward long-

[7] The reader should note that when π moves freely with $dp=0$ (as result of trade balance) the following conclusion is strengthened. When dF and dC are positive and negative respectively, $d\pi$ and dp are negative and positive respectively (and vice versa), and with the sign of each element and the assumption of freely moving π, it is easily shown that in the case of $d\pi\neq 0$ the result obtained in Section II remains unchanged (and rather strengthened), because, in this case, we have the following equations.

$$\begin{bmatrix} \dot{F} \\ \dot{C} \end{bmatrix}=\begin{bmatrix} - & + \\ + & - \end{bmatrix}\begin{bmatrix} d\pi \\ 0 \end{bmatrix}+\begin{bmatrix} + & + \\ - & - \end{bmatrix}\begin{bmatrix} dF \\ dC \end{bmatrix}.$$

Therefore, in that sense, the assumption is just for simplification.

[8] This means that asset holders' expectation is still unchanged throughout the intervention. With improvement in expectation formation theory, this assumption should be replaced by much stronger one.

[9] The result obtained in Section II largely depends upon this inequality (22). Needless to say, this assumption tells us other possible stories. For example, if the opposite assumption describes the situation more realistically, the result in Section II will have no power to interpret the real world. But the reader should note that it does not bear any relation to the result in Section I.

run equilibrium it is necessary for F to decrease, and/or for C to increase. In a stable system as described in the previous section, the excessive F and the short C both disappear through the adjustment processes, i.e., $\dot{F}<0$ and $\dot{C}>0$. But the process obtained in this section with buffer stock operation is not stable. The system including such an intervening mechanism makes the disequilibrium expand, i.e., $\dot{F}>0$ and $\dot{C}<0$. It is unstable. Needless to say, the system examined in this paper becomes unstable due to the intervention.

Economic interpretation of the unstable adjustment is similar to the adjustment mentioned in the previous section. Positive $\dot{F}$ implies that the surplus in the foreign country's trade account increases and the value of domestic money declines. Although the quantity of domestic money may shrink, as the desired level of domestic money $\bar{F}$ drops lower, the difference between the desired and the existing level dF continues to expand. Negative $\dot{C}$ indicates that excess demand for the primary commodity in the goods market appears and that the stock disequilibrium in real terms deteriorates. This excess demand makes the desired level of the primary commodity $\bar{C}$ much higher. Therefore the difference dC continues to expand.

Moreover, the above-mentioned process may increase the tendency that p will go up and π will go down much further. If so, the ICA will have to intervene in the market constantly.

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