

Buiter, Willem Hendrik

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Macroeconomic Policy Design in an Interdependent World Economy: An Analysis of Three Contingencies

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ECONOMIC GROWTH CENTER

YALE UNIVERSITY

P.O. Box 1987, Yale Station
27 Hillhouse Avenue
New Haven, Connecticut 06520

CENTER DISCUSSION PAPER NO. 492

MACROECONOMIC POLICY DESIGN IN AN INTERDEPENDENT
WORLD ECONOMY: AN ANALYSIS OF THREE CONTINGENCIES

Willem H. Buiter

Yale University

and

National Bureau of Economic Research

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Notes: Center Discussion Papers are preliminary materials circulated to stimulate discussion and critical comment. References in publications to Discussion Papers should be cleared with the author to protect the tentative character of these papers.

ABSTRACT

The paper uses a small analytical two-region (the United States and the Rest of the Industrial World) model, to analyze three issues concerning international economic interdependence and macroeconomic policy coordination that have been raised in connection with the September 1985 World Economic Outlook published by the IMF. They are: (1) What should be the monetary and/or fiscal response in the Rest of the Industrial World to a tightening of U.S. fiscal policy and what should be the U.S. monetary response? (2) What should be the monetary and/or fiscal response in the United States and in the Rest of the Industrial World to a "collapse of the U.S. dollar?" The paper highlights the importance of determining the causes of such a "hard landing" for the U.S. dollar, as the appropriate policy responses are very sensitive to this; (3) What should be the macroeconomic policy response in the Industrial World to a disappointing real growth performance? Again the correct identification of the reason(s) for the disappointment is shown to be crucial.

The final section discusses and qualifies the activist policy conclusions derived from the formal analysis.

Willem H. Buiter, "Macroeconomic Policy Design in an Interdependent World Economy: An Analysis of Three Contingencies."

I. Introduction*

The September 1985 issue of the IMF's World Economic Outlook (WEO) clearly reflects this institution's concern with international economic interdependence and macroeconomic policy coordination. In this paper I take up three policy issues that were the subject of widespread discussion, both in the Fund and outside it during the period leading up to the publication of the WEO. They are:

(1) What should be the monetary and/or fiscal response in the rest of the industrialized world to a unilateral tightening of U.S. fiscal policy and what should be the U.S. monetary response?

(2) What should be the monetary and fiscal response in the industrialized countries to a sudden, large change in an important exchange rate? For concreteness I shall refer to this event as a "collapse of the U.S. dollar"; and

(3) What should be the policy response in the industrialized world to a disappointing real growth performance?

All three issues are clearly of more than academic interest. In this paper I attempt to give qualitative answers using a simple analytical model. However simple the individual country models may be, the interdependent global economic system very soon grows too large for analytical treatment; numerical simulation methods are called for. I propose to investigate these same issues using a richer and more detailed three-country or three-region numerical simulation model in a sequel to this paper. Recent work by Sachs [1985] and by Sachs and McKibbin [1985] has demonstrated the usefulness of such an approach. The advantages in terms of intuition and insight from keeping things sufficiently small

* This paper was written while I was a consultant in the Research Department of the IMF. The topic was suggested to me by Andrew D. Crockett. The opinions expressed in the paper are my own.

The research reported here is part of the NBER's research program in International Studies. Any opinions expressed are those of the author and not those of the National Bureau of Economic Research.

and transparent to permit a simple algebraic and diagrammatic analysis are such, however, that a first pass at this problem "in two dimensions" is justified.

Section II.1 outlines the simple two-country Dornbusch-style model with a floating exchange rate, perfect capital mobility, rational exchange rate expectations and gradual price adjustment. The long-run or steady-state comparative statics are reviewed in Section II.2 while Section II.3 characterizes the nature of the dynamic adjustment process. Possible responses to a tightening of U.S. fiscal policy are reviewed in Section III. In Section IV possible responses to a collapse of the U.S. dollar are considered and Section V deals with the policy implications of a slowdown in world economic activity. Qualifications and conclusions are found in Section VI.

II. An Analytical Approach

II.1. The model

Consider the simple two-country or two-region version of the Dornbusch [1976] open macroeconomic model with a freely floating exchange rate and perfect capital mobility given in equations (1)-(12) below. Except for some inconsequential differences, this model is the one used by Miller [1982]. (See also Buiter [1985a] for another application.) All variables other than interest rates are in natural logarithms.

All coefficients are non-negative. Country 1 will be referred to as the USA and country 2 as the Rest of the World (ROW).

$$(1) \quad m_1 - p_1 = k_1 y_1 - \lambda_1 i_1 + \eta_1$$

$$(2) \quad y_1 = -\gamma_1 r_1 + \delta_{12}(e + p_2 - p_1) + \varepsilon_{12} y_2 + f_1$$

$$(3) \quad \dot{p}_1 = \psi_1(y_1 - \bar{y}_1) + \dot{m}_1$$

$$(4) \quad r_1 = i_1 - \dot{p}_1$$

$$(5) \quad i_1 = i_2 + \dot{e} + \tau_2 - \tau_1$$

$$(6) \quad m_2 - p_2 = k_2 y_2 - \lambda_2 i_2 + \eta_2$$

$$(7) \quad y_2 = -\gamma_2 r_2 - \delta_{21}(e + p_2 - p_1) + \epsilon_{21} y_1 + f_2$$

$$(8) \quad \dot{p}_2 = \psi_2(y_2 - \bar{y}_2) + \dot{m}_2$$

$$(9) \quad r_2 = i_2 - \dot{p}_2$$

$$(10) \quad c \equiv e + p_2 - p_1$$

$$(11) \quad l_1 \equiv m_1 - p_1$$

$$(12) \quad l_2 \equiv m_2 - p_2$$

m_j is the nominal money stock of country j , p_j its GDP deflator, y_j its real output, i_j its nominal interest rate and r_j its real interest rate. e is the nominal exchange rate, expressed as the number of units of country 1's currency per unit of country 2's currency. f_j is a measure of fiscal stance in country j , τ_j is country j 's tax rate on interest income accruing from abroad and its subsidy rate on the interest cost of borrowing from abroad. These taxes drive a wedge between the domestic nominal interest rate and the interest rate on loans denominated in the same currency overseas. c is the real exchange rate or competitiveness and l_j country j 's stock of real money balances.

The model has rational exchange rate expectations and rational inflation expectations by investors. The exchange rate is set in an efficient, forward-looking asset market. It can make discrete "jumps"

at a point in time in response to "news". Domestic costs (p_j) are predetermined (i.e. given at a point in time), but their rates of change respond to excess demand or supply and "core inflation".

The model will have short-run "Keynesian" but long-run classical or monetarist features. Each country's demand for real money balances varies positively with its own national income y_j and negatively with its own nominal interest rate i_j . ^{1/} There is no endogenous direct currency substitution. A shift parameter η_j is added to allow for portfolio shifts. The demand for each country's output depends on its real interest rate r_j , on competitiveness, c , on the other country's level of real income and on the domestic fiscal impulse f_j . Domestic costs are governed by an augmented Phillips curve. The (logarithm of the) level of capacity output \bar{y}_j (or the natural rate of unemployment) in each country is exogenous. The augmentation term in the Phillips curve is taken to be the current rate of growth of the money stock \dot{m}_j . This is done merely to permit a simple diagrammatic analysis of the model's properties. More satisfactory ways of modelling the augmentation term are discussed in Buiter

^{1/} We could specify the demand for real money balances as a demand for money balances in terms of the country's consumption bundle. Let country 1's consumer price index \tilde{p}_1 be a weighted average of the domestic value added deflator and the domestic currency value of the foreign value added deflator, i.e. $\tilde{p}_1 = \alpha_1 p_1 + (1-\alpha_1)(e+p_2)$ $0 < \alpha_1 < 1$. Money demand is a function of real income $y_1 + p_1 - \tilde{p}_1 = y_1 + (\alpha_1 - 1)c$ and the nominal interest rate, i.e.

$$m_1 - \tilde{p}_1 = k_1(y_1 + p_1 - \tilde{p}_1) - \lambda_1 i_1 \quad \text{or}$$

$$l_1 = k_1 y_1 - \lambda_1 i_1 + (k_1 - 1)(\alpha_1 - 1)c$$

This equals our equation (1) when $k_1 = 1$. Nothing substantial is lost and some notational simplicity is gained by sticking with equation (1).

and Miller [1982, 1983a,b] and will be incorporated in the larger macro-economic model that is solved using numerical methods in a sequel to this paper.

The two countries are not only linked via competitiveness and activity effects but also directly through an integrated international financial market. Equation (5) represents the condition for (after-tax) uncovered interest parity. US and ROW currency-denominated interest-bearing assets are perfect substitutes in private portfolios. This will be the case if the international financial markets are efficient and there are risk-neutral speculators.

It will be convenient to represent the essential dynamics of this mini-world economic world through three state variables, l_j , $j=1,2$, real money balances in each of the two countries and c , U.S.A. competitiveness.

II.2. The long run equilibrium

The long-run comparative statics in this model are completely classical or monetarist. Output in each country is at its exogenously given full employment level and changes in the levels and growth rates of nominal money stocks are translated into corresponding changes in the levels and proportional rates of change of costs and of the exchange rate. Equation

(13a-i) summarizes the long run equilibrium of this economy.

$$(13a) \quad y_i = \bar{y}_i \quad i = 1, 2$$

$$(13b) \quad \dot{p}_i = \dot{m}_i \quad i = 1, 2$$

$$(13c) \quad \dot{e} = \dot{m}_1 - \dot{m}_2$$

$$(13d) \quad r_1 = r_2 + \tau_2 - \tau_1$$

$$(13e) \quad c = \frac{1}{\Lambda} [\gamma_1 f_2 - \gamma_2 f_1] - \frac{\gamma_1 \gamma_2}{\Lambda} (\tau_1 - \tau_2) + \frac{(\gamma_2 + \gamma_1 \epsilon_{12})}{\Lambda} \bar{y}_1 - \frac{(\gamma_1 + \gamma_2 \epsilon_{12})}{\Lambda} \bar{y}_2$$

$$(13f) \quad r_1 = \frac{1}{\Lambda} [\delta_{12} f_2 + \delta_{21} f_1] - \frac{\delta_{12} \gamma_2}{\Lambda} (\tau_1 - \tau_2) + \frac{(\delta_{12} \epsilon_{21} - \delta_{21})}{\Lambda} \bar{y}_1 + \frac{(\delta_{21} \epsilon_{12} - \delta_{12})}{\Lambda} \bar{y}_2$$

$$(13g) \quad r_2 = \frac{1}{\Lambda} [\delta_{12} f_2 + \delta_{21} f_1] + \frac{\delta_{21} \gamma_1}{\Lambda} (\tau_1 - \tau_2) + \frac{(\delta_{12} \epsilon_{21} - \delta_{21})}{\Lambda} \bar{y}_1 + \frac{(\delta_{21} \epsilon_{12} - \delta_{12})}{\Lambda} \bar{y}_2$$

$$(13h) \quad \dot{e}_1 = \frac{-\lambda_1}{\Lambda} (\delta_{12} f_2 + \delta_{21} f_1) + \frac{\lambda_1 \delta_{12} \gamma_2}{\Lambda} (\tau_1 - \tau_2) - \lambda_1 \dot{m}_1 + \eta_1 \\ + (k_1 - \frac{\lambda_1 (\delta_{12} \epsilon_{21} - \delta_{21})}{\Lambda}) \bar{y}_1 - \frac{\lambda_1 (\delta_{21} \epsilon_{12} - \delta_{12})}{\Lambda} \bar{y}_2$$

$$(13i) \quad \dot{e}_2 = \frac{-\lambda_2}{\Lambda} (\delta_{12} f_2 + \delta_{21} f_1) - \frac{\lambda_2 \delta_{21} \gamma_1}{\Lambda} (\tau_1 - \tau_2) - \lambda_2 \dot{m}_2 + \eta_2 \\ + (k_2 - \frac{\lambda_2 (\delta_{21} \epsilon_{12} - \delta_{12})}{\Lambda}) \bar{y}_2 - \frac{\lambda_2 (\delta_{12} \epsilon_{21} - \delta_{21})}{\Lambda} \bar{y}_1$$

where

$$(13j) \quad \Lambda = \delta_{21} \gamma_1 + \delta_{12} \gamma_2$$

In the long run (at full employment) fiscal expansion in the U.S. worsens U.S. competitiveness while fiscal expansion in the ROW causes U.S. competitiveness to improve. Neither changes in the levels nor in the rates of growth of the nominal money stocks affect real competitiveness or real interest rates. Fiscal expansion in the United States or in the ROW raises the world real interest rate. (note that the U.S. and ROW real

interest rates differ only to the extent that U.S. and ROW taxes (subsidies) on foreign interest income (costs) differ. An increase in $\tau_1 - \tau_2$ lowers the U.S. real interest rate and raises that in the ROW. Competitiveness therefore must move against the U.S.A. to restore equilibrium in the market for U.S. output. An increase in \dot{m}_1 raises \dot{p}_1 and the rate of depreciation of country 1's currency by the same amount. A higher nominal interest rate reduces the stock of real money balances demanded in the long run, if the interest-sensitivity of the demand for real money balances is non-zero. Given the rate of money growth (and thus the rate of inflation), expansionary fiscal policy in either country, by raising the real interest rate, also raises the nominal interest rate and reduces the demand for real money balances at home and abroad.

An increase in the level of capacity output (\bar{y}_1) of a country is associated with an improvement in its long run competitiveness. This is required in order for the market to absorb the relatively greater supply of that country's output. Assuming that $\delta_{12}\epsilon_{21} - \delta_{12}$ and $\delta_{21}\epsilon_{12} - \delta_{12}$ are both negative, an increase in the level of capacity output in either country lowers the long-run real interest rate in both countries; the lower real interest rates stimulate demand and bring it back to equality with the larger level of full employment output. Both directly, via the income effect on money demand and indirectly, by lowering the nominal interest rate (since real interest decline and money growth is held constant), increased capacity output in either country raises the long-run stock of real money balances in both countries.

II.3. The dynamic response to policy changes and exogenous shocks

The three simultaneous state equations of the unrestricted model are available from the author on request. When the restriction is imposed that the two countries or regions have identical structures, it becomes possible to provide an analytical and diagrammatic exposition of the main policy issues [see Aoki [1981] and Miller[1982]]. The assumption of identical structures is of course quite restrictive. All differences in country performance must be attributed solely to different policies, different exogenous shocks or different initial conditions. A full analysis of two or three country models which allows for inter-country differences in the specification of major behavioral relationships will require numerical simulation methods. The simplified two-country model does, however, permit a very transparent first pass at the major policy issues. Symmetry in this model means that $k_1 = k_2 = k$; $\lambda_1 = \lambda_2 = \lambda$; $\gamma_1 = \gamma_2 = \gamma$; $\delta_{12} = \delta_{21} = \delta$; $\epsilon_{12} = \epsilon_{21} = \epsilon$; $\psi_1 = \psi_2 = \psi$.

The three simultaneous state equations of the unrestricted model can be decomposed into two independent subsystems when the restriction of identical structures is imposed. A two-dimensional system involves the real exchange rate and the difference between the two countries' real money stocks. Let $l^d \equiv l_1 - l_2$, $\dot{m}^d \equiv \dot{m}_1 - \dot{m}_2$; $\eta^d \equiv \eta_1 - \eta_2$, $f^d \equiv f_1 - f_2$, $\tau^d \equiv \tau_1 - \tau_2$ and $\bar{y}^d \equiv \bar{y}_1 - \bar{y}_2$

$$(14a) \quad \begin{bmatrix} \dot{l}^d \\ E_t \dot{c} \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} l^d \\ c \end{bmatrix} + \begin{bmatrix} b_{11} & b_{12} & b_{13} & b_{14} & b_{15} \\ b_{21} & b_{22} & b_{23} & b_{24} & b_{25} \end{bmatrix} \begin{bmatrix} \dot{m}^d \\ \eta^d \\ f^d \\ \tau^d \\ \bar{y}^d \end{bmatrix}$$

where

$$a_{11} = -\psi\lambda^{-1} \gamma(\Omega+\epsilon)^{-1}; a_{12} = -2\psi\delta(\Omega+\epsilon)^{-1}$$

$$a_{21} = -\lambda^{-1}(1+\epsilon)(\Omega+\epsilon)^{-1}; a_{22} = 2\Gamma\delta(\Omega+\epsilon)^{-1}$$

$$b_{11} = -\psi\gamma(\Omega+\epsilon)^{-1}; b_{12} = \psi\lambda^{-1} \gamma(\Omega+\epsilon)^{-1}; b_{13} = -\psi(\Omega+\epsilon)^{-1}$$

$$b_{14} = 0; b_{15} = \psi(1+\gamma\psi(\Omega+\epsilon)^{-1})$$

$$b_{21} = -(1+\epsilon)(\Omega+\epsilon)^{-1}; b_{22} = \lambda^{-1}(1+\epsilon)(\Omega+\epsilon)^{-1}; b_{23} = \Gamma(\Omega+\epsilon)^{-1}$$

$$b_{24} = 1; b_{25} = \psi(1-\Gamma\gamma(1-\Gamma\gamma(\Omega+\epsilon)^{-1}))$$

and

$$\Omega \equiv 1 + \gamma\Gamma$$

$$\Gamma \equiv \lambda^{-1}k - \psi$$

A one-dimensional system involves only averages or global magnitudes.

$$\text{Let } \ell^a \equiv \frac{\ell_1 + \ell_2}{2}; \dot{m}^a \equiv \frac{\dot{m}_1 + \dot{m}_2}{2}; f^a \equiv \frac{f_1 + f_2}{2}; \eta^a \equiv \frac{\eta_1 + \eta_2}{2}; \tau^a \equiv \frac{\tau_1 + \tau_2}{2}$$

$$\text{and } \bar{y}^a \equiv \frac{\bar{y}_1 + \bar{y}_2}{2}$$

We have

$$(14b) \quad \dot{\ell}^a = -\psi\lambda^{-1}(\Omega-\epsilon)^{-1}\gamma\ell^a + [-\psi\gamma(\Omega-\epsilon)^{-1} \psi\lambda^{-1}\gamma(\Omega-\epsilon)^{-1} - \psi(\Omega-\epsilon)^{-1} \circ \psi(1+(\Omega-\epsilon)^{-1}\gamma\psi)] \begin{bmatrix} \dot{m}^a \\ \eta^a \\ f^a \\ \tau^a \\ \bar{y}^a \end{bmatrix}$$

The "output equations," the equations giving the short-run endogenous variables as functions of the state variables and the exogenous variables are (using self-explanatory notation):

$$(15a) \begin{bmatrix} y^d \\ i^d \\ p^d \end{bmatrix} = \begin{bmatrix} (\Omega+\epsilon)^{-1}\gamma\lambda^{-1} & 2(\Omega+\epsilon)^{-1}\delta \\ -\lambda^{-1}(1-\gamma\psi+\epsilon)(\Omega+\epsilon)^{-1} & 2\lambda^{-1}k(\Omega+\epsilon)^{-1}\delta \\ (\Omega+\epsilon)^{-1}\psi\gamma\lambda^{-1} & 2\psi\delta(\Omega+\epsilon)^{-1} \end{bmatrix} \begin{bmatrix} l^d \\ c \end{bmatrix}$$

$$+ \begin{bmatrix} (\Omega+\epsilon)^{-1}\gamma & -(\Omega+\epsilon)^{-1}\gamma\lambda^{-1} & (\Omega+\epsilon)^{-1} & 0 & -(\Omega+\epsilon)^{-1}\gamma\psi \\ (\Omega+\epsilon)^{-1}\lambda^{-1}k\gamma & \lambda^{-1}(1-\gamma\psi-\epsilon)(\Omega+\epsilon)^{-1} & (\Omega+\epsilon)^{-1}\lambda^{-1}k & 0 & -\lambda^{-1}k\gamma\psi(\Omega+\epsilon)^{-1} \\ 1+(\Omega+\epsilon)^{-1}\psi\gamma & -(\Omega+\epsilon)^{-1}\psi\gamma\lambda^{-1} & (\Omega+\epsilon)^{-1}\psi & 0 & -\psi(1+(\Omega+\epsilon)^{-1}\gamma\psi) \end{bmatrix} \begin{bmatrix} m^d \\ n^d \\ f^d \\ \tau^d \\ \bar{y}^d \end{bmatrix} \quad \underline{2/}$$

and

$$(15b) \begin{bmatrix} y^a \\ i^a \\ p^a \\ r^a \end{bmatrix} = \begin{bmatrix} (\Omega-\epsilon)^{-1}\gamma\lambda^{-1} \\ -\lambda^{-1}(1-\gamma\psi-\epsilon)(\Omega-\epsilon)^{-1} \\ (\Omega-\epsilon)^{-1}\psi\gamma\lambda^{-1} \\ -\lambda^{-1}(1-\epsilon)(\Omega-\epsilon)^{-1} \end{bmatrix} [l^a] + \begin{bmatrix} (\Omega-\epsilon)^{-1}\gamma & -(\Omega-\epsilon)^{-1}\gamma\lambda^{-1} & (\Omega-\epsilon)^{-1} & 0 & -(\Omega-\epsilon)\gamma\psi \\ (\Omega-\epsilon)^{-1}\lambda^{-1}k\gamma & \lambda^{-1}(1-\gamma\psi-\epsilon)(\Omega-\epsilon)^{-1} & (\Omega-\epsilon)^{-1}\lambda^{-1}k & 0 & -\lambda^{-1}k\gamma\psi(\Omega-\epsilon)^{-1} \\ 1+(\Omega-\epsilon)^{-1}\psi\gamma & -(\Omega-\epsilon)^{-1}\psi\gamma\lambda^{-1} & (\Omega-\epsilon)^{-1}\psi & 0 & -\psi(1+(\Omega-\epsilon)^{-1}\gamma\psi) \\ -[1-\epsilon](\Omega-\epsilon)^{-1} & \lambda^{-1}(1-\epsilon)(\Omega-\epsilon)^{-1} & (\Omega-\epsilon)^{-1}\Gamma & 0 & \psi(1-\Gamma\gamma(\Omega-\epsilon)^{-1}) \end{bmatrix} \begin{bmatrix} m^a \\ n^a \\ f^a \\ \tau^d \\ \bar{y}^d \end{bmatrix}$$

The long-run comparative statics for the differences and averages can be obtained easily from equations (13a)-(13i)

$$(16a) \quad \dot{z}^d = -\lambda_m^d \dot{m}^d + \eta^d + \lambda \tau^d + k \bar{y}^d$$

$$(16b) \quad c = -\frac{1}{2\delta} f^d - \frac{\gamma}{2\delta} \tau^d + \frac{(1+\epsilon)}{2\delta} \bar{y}^d$$

$$(16c) \quad r^d = -\tau^d$$

$$(16d) \quad \dot{z}^a = -\lambda_m^a \dot{m}^a + \eta^a - \frac{\lambda}{\gamma} f^a + (k + \frac{\lambda(1-\epsilon)}{\gamma}) \bar{y}^a$$

$$(16e) \quad r^a = \frac{1}{\gamma} f^a + \frac{(\epsilon-1)}{\gamma} \bar{y}^a$$

Global or average economic performance and the difference between the economic performances of the two countries are "decoupled": they can be studied independently of each other, with average outcomes a function only of current and past average policy instrument values and average exogenous shocks, while performance differences are a function only of differences in current, past and expected future differences in policy instrument values and exogenous disturbances. The "averages" model (equations (14b) and (15b)) can indeed be viewed as a self-contained model of a single closed economy. Because the price deflators are pre-determined and the real exchange rate "washes out" through the assumption of symmetrical structures, the "averages" model contains no nonpredetermined, forward-looking or jump variables. In the richer structure of the simulation model in the sequel to this paper, the average or global economy does contain forward-looking variables, through forward-looking investment decisions (Tobin's q) and wage setting. Note that after analyzing and averages and differences, we can easily retrieve individual country performance, since $l_1 = 1/2 \dot{l}^d + l^a$, $l_2 = -1/2 \dot{l}^d + l^a$, etc.

The "averages" economy (equation 14b) with its single predetermined state variable will be stable if and only if $-\Psi\lambda^{-1}(\Omega - \epsilon)^{-1}\gamma < 0$ that is i.f.f.

$$(17a) \quad \Omega > \epsilon$$

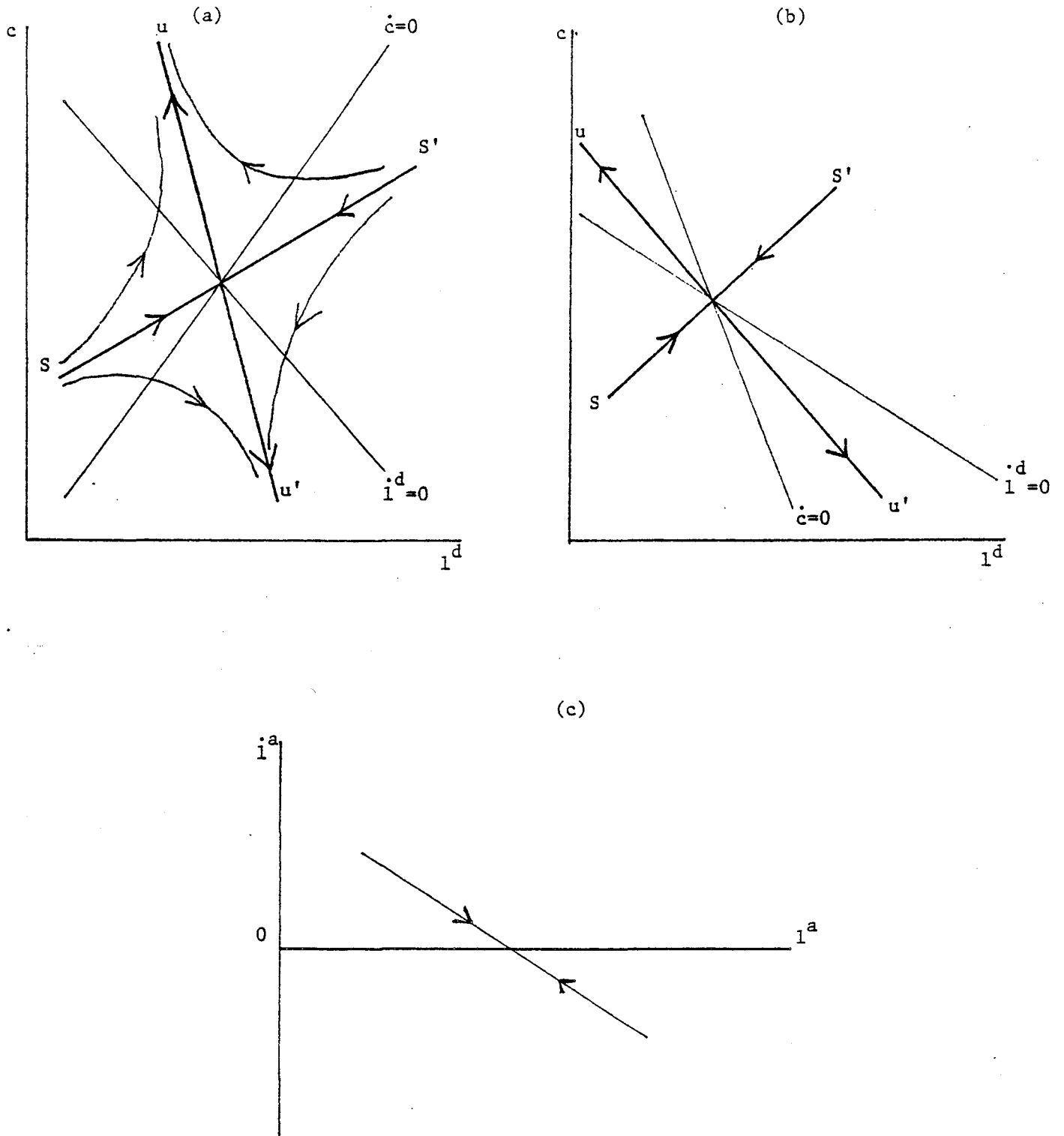
The "differences" system (equation 14a) with its predetermined variable l^d and its non-predetermined variable c , will have a unique convergent saddlepoint equilibrium if and only if $a_{11} a_{22} - a_{21} a_{12} < 0$ that is i.f.f.

$$(17b) \quad \Omega > -\epsilon$$

Since $\epsilon > 0$, (17a) implies (17b)

$\Omega > -\epsilon$ is equivalent to the condition that an improvement in U.S. competitiveness will (given l^d , \dot{m}^d , n^d , f^d and r^d) raise the effective demand for U.S. output relative to output in the rest of the world. It is a weak condition, which amounts to assuming that in a diagram with the nominal interest rate on the vertical axis and output on the horizontal axis, the IS curve (after using the Phillips curve to substitute out the (expected) rate of inflation) is either downward-sloping or upward-sloping and steeper than the LM curve. I assume that 17(a) is satisfied. Given (17a) (and thereby (17b)), the saddlepoint equilibrium and the "differences" system either looks like Figure 1a (when the IS curve is downward-sloping, $a_{22} > 0$ 3/ and the $\dot{c}=0$ locus is upward-sloping) or like Figure 1b (when the IS curve is upward-sloping and steeper than the LM curve, $a_{22} < 0$ and the $\dot{c} = 0$ locus is downward-sloping and cuts the $\dot{l}^d=0$ locus from above). Since the phase diagram is qualitatively similar in the two cases, I shall restrict the analysis to the case depicted in Figure 1(a). Figure 1(c) depicts the adjustment process of the single predetermined state variable for the "averages" system.

Figure 1



Equilibrium and dynamic adjustment in the symmetric two-country model.

First among the policy issues to be considered now is the proper response in the ROW to a unilateral U.S. fiscal contraction.

III. Responses to a tightening of U.S. fiscal policy

III.1. U.S. fiscal tightening without fiscal or monetary response in the ROW and without monetary response in the U.S.A

A fiscal tightening in the U.S.A. without any fiscal response in the ROW is, in the notation of this paper, a reduction in the average fiscal impulse (f^a) and a reduction in the difference between the two countries' fiscal impulses f^d which is twice as large as the reduction in f^a . From equations 16(a-e) it is clear that the long-run consequences of this unilateral fiscal contraction will be the following:

- (1) an improvement in the U.S.A's competitiveness (c increases);
- (2) a lowering of the real interest rate in the U.S.A. and in the rest of the world;
- (3) an increase in the world real money stock because nominal as well as real interest rates are lower in the U.S. and in the R.O.W.

In Figure 2a we see that for c and l^d , the full long-run adjustment from E_1 to E_2 occurs instantaneously. Relative US-ROW real money balances are unaffected by the U.S. fiscal tightening. The required long-run depreciation in the real exchange rate can therefore be brought about immediately by a "jump" or step depreciation in the nominal exchange rate of the United States.

In the new long-run equilibrium the global stock of real money balances will be larger since lower nominal interest rates raise velocity. Given nominal money growth rates in the U.S. and the ROW and without any discrete changes in the levels of the nominal money stocks, the process of increasing real balances requires that the rate of inflation be held below the given rates of growth of the nominal money stocks. There will therefore be a temporary global recession: y^a declines. The global recession affects the U.S. and the R.O.W. equally: y^d is zero throughout the adjustment process. U.S. output declines because of the fiscal tightening but the decline is mitigated somewhat as competitiveness improves. The ROW suffers from its loss of competitiveness, which mirrors the improvement in the U.S. competitiveness. The recession is therefore concentrated in the non-traded goods sector of the U.S. and the traded goods sector of the ROW. Nominal and real interest rates and inflation rates in the U.S. and the ROW are affected equally by the U.S. fiscal contraction: i^d , r^d and \dot{p}^d are zero throughout. Both nominal and real interest rates decline globally (and in each country). As in the familiar closed economy IS-LM, augmented Phillips curve model, the decline in nominal and real interest rates mitigates the contraction of aggregate demand but does not undo it completely. There is "crowding out" (in our policy experiment a reversal of crowding out) but less than 100 percent. Note that because inflation declines during the recession, real interest

Figure 2a

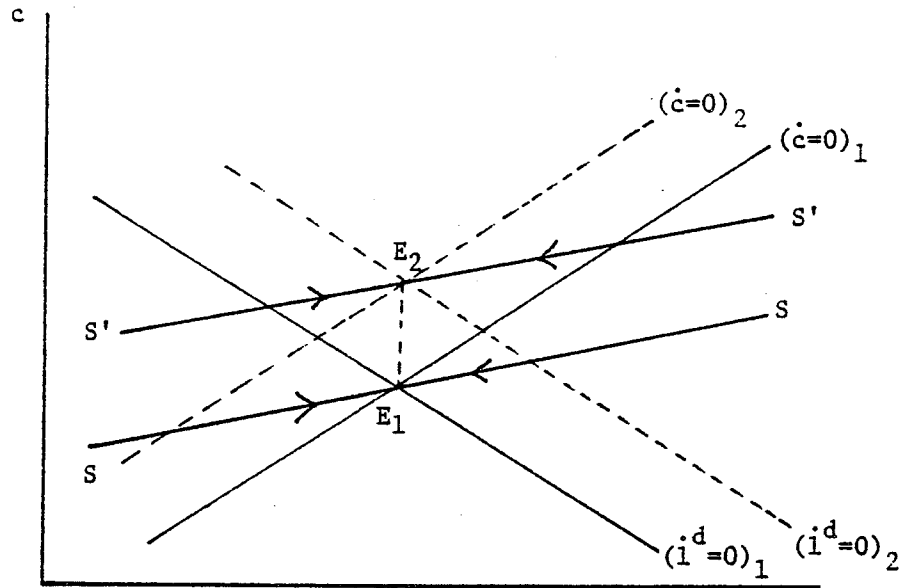
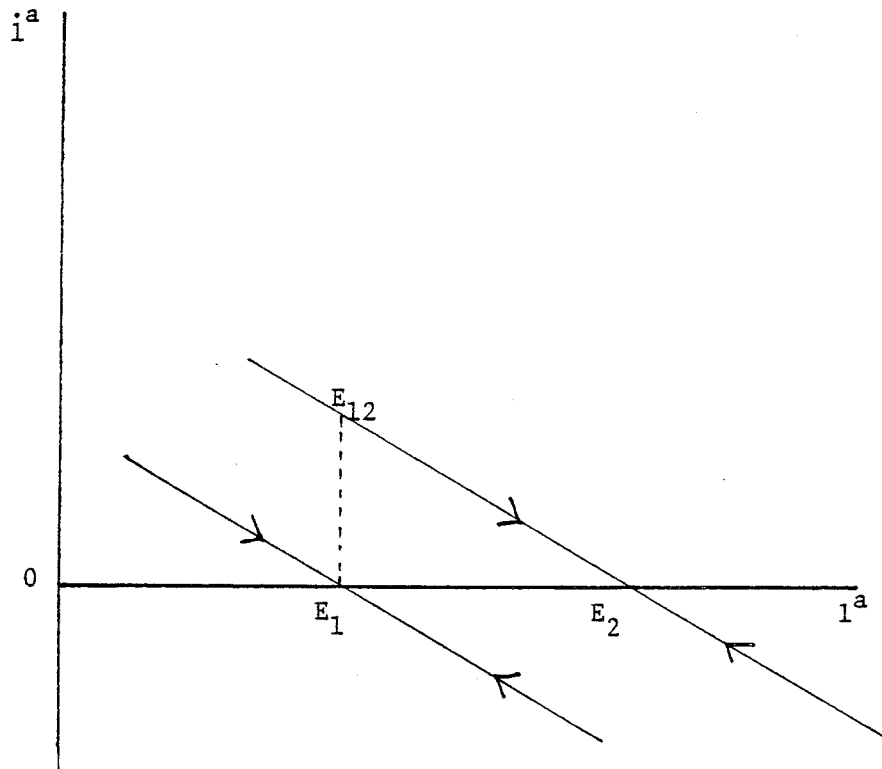


Figure 2b



rates come down by less than nominal interest rates. Figure 3 summarizes the response to the unexpected announcement at time t_0 of an immediately implemented permanent tightening of U.S. fiscal policy. ^{1/}

III.2 Monetary policy stabilizes the nominal exchange rate

One of the scenarios considered in the WEO consists of a tightening of U.S. fiscal policy, unaccommodating U.S. monetary policy, unchanged fiscal policy in the ROW and monetary policy in the ROW geared to interest rate coupling. Given perfect international capital mobility, interest rate coupling amounts to having a fixed nominal exchange rate. Under a fixed exchange rate regime, a fiscal contraction in the U.S. will, with perfect capital mobility, lead to a stock-shift outflow of capital from the U.S., a stock-shift loss U.S. foreign exchange reserves and a corresponding contraction in the U.S. money stock. The ROW experiences the counterpart stock-shift inflow of capital, stock-shift gain in foreign exchange reserves and expansion of its money stock. It is therefore arbitrary whether one assigns the stabilization of the exchange rate to the monetary policy of the ROW or to the U.S. Under a fixed exchange rate regime (which is expected to be permanent) there is effectively a single global world money market or world LM schedule. Individual countries can choose their own rates of domestic credit expansion and thus collectively determine the growth of the world money stock. The distribution of this world money stock across countries is determined by the individual countries'

^{1/} For i^a to decline less on impact than in the long run, we must assume that $1-\gamma\psi-\epsilon > 0$. For r^a to decline less on impact than in the long run, we must assume that $\epsilon < 1$.

money demand functions, with reserve flows making up the difference between changes in domestic money demand and domestic credit expansion.

The formal analysis of the fixed exchange rate regime is very simple. Let the global stock of gold and foreign exchange reserves be constant and, for notational simplicity, equal to zero. The global money stock is therefore the sum of the two countries' stocks of domestic credit. Let m be the logarithm of the global nominal money stock, D_i the logarithm of country i 's stock of domestic credit and v the share of U.S. domestic credit is total domestic credit.

$$(18a) \quad m \equiv vD_1 + (1-v)D_2 \quad 0 < v < 1.$$

Setting the logarithm of the fixed nominal exchange rate equal to zero, we define the global price level, p , as follows:

$$(18b) \quad p \equiv vp_1 + (1-v)p_2$$

The global money demand shock η is similarly defined as:

$$(18c) \quad \eta = v\eta_1 + (1-v)\eta_2$$

and global income as

$$(18d) \quad y = vy_1 + (1-v)y_2$$

$\mu_1 \equiv \dot{D}_1$ is the proportional rate of growth of country i 's domestic credit. (Under a freely floating exchange rate regime, $\mu_1 \equiv \dot{m}_1$.) The augmentation term in the Phillips curve is taken to be the policy-determined μ_1 rather than the endogenously determined \dot{m}_1 . No fixed exchange rate regime is viable unless inflation rates converge. I therefore impose $\mu_1 = \mu_2 = \mu$. This still permits short-term divergence of inflation rates. Also define $i \equiv i_1 = i_2 + \tau_2 - \tau_1$. The model consists of

equations (20)-(23) and (2), (4), (7) and (9). Identical structures are again assumed.

$$(20) \quad l = ky - \lambda i + \eta - (1-\nu)\lambda(\tau_1 - \tau_2)$$

$$(21) \quad \dot{p}_1 = \psi(y_1 - \bar{y}_1) + \mu$$

$$(22) \quad \dot{p}_2 = \psi(y_2 - \bar{y}_2) + \mu$$

$$(23) \quad l \equiv m - p$$

For algebraic simplicity and in order to retain comparability with the floating exchange rate case, both countries are assumed to be of equal size so $\nu = 1/2$.

The fixed exchange rate version has two state variables, l and c which are both predetermined. The equations of motion and the determination of output in the two countries are given in equations (24) and

(25) respectively.

$$(24) \quad \begin{bmatrix} \dot{l} \\ \dot{c} \end{bmatrix} = \begin{bmatrix} -\psi(K_1+K_2)^{-1}\gamma\lambda^{-1} & 0 \\ 0 & -2\psi(K_1-K_2)^{-1}\delta \end{bmatrix} \begin{bmatrix} l \\ c \end{bmatrix} + \begin{bmatrix} -\psi(K_1+K_2)^{-1}\gamma & \psi(K_1+K_2)^{-1}\gamma\lambda^{-1} & -\psi\frac{(K_1+K_2)^{-1}}{2} & -\psi\frac{(K_1+K_2)^{-1}}{2} & 0 & \psi\frac{[1+\psi\gamma(K_1+K_2)^{-1}]}{2} & \psi[1+\psi\gamma(K_1+K_2)^{-1}] \\ 0 & 0 & -\psi(K_1-K_2)^{-1} & \psi(K_1-K_2)^{-1} & -\psi\gamma(K_1-K_2)^{-1} & \psi[1+\psi\gamma(K_1-K_2)^{-1}] & -\psi[1+\psi\gamma(K_1-K_2)^{-1}] \end{bmatrix} \begin{bmatrix} \mu \\ \eta \\ f_1 \\ f_2 \\ \tau_1 - \tau_2 \\ \bar{y}_1 \\ \bar{y}_2 \end{bmatrix}$$

$$(25) \quad \begin{bmatrix} y_1 \\ y_2 \end{bmatrix} = \begin{bmatrix} (K_1+K_2)^{-1}\gamma\lambda^{-1} & (K_1-K_2)^{-1}\delta \\ (K_1+K_2)^{-1}\gamma\lambda^{-1} & -(K_1-K_2)^{-1}\delta \end{bmatrix} \begin{bmatrix} l \\ c \end{bmatrix} + \begin{bmatrix} (K_1+K_2)^{-1}\gamma & -(K_1+K_2)^{-1}\gamma\lambda^{-1} & K_1\Delta^{-1} & -K_2\Delta^{-1} & K_1\Delta^{-1}\gamma - (K_1+K_2)^{-1}\gamma\frac{1}{2} & -K_1\Delta^{-1}\gamma\psi & K_2\Delta^{-1}\gamma\psi \\ (K_1+K_2)^{-1}\gamma & -(K_1+K_2)^{-1}\gamma\lambda^{-1} & -K_2\Delta^{-1} & K_1\Delta^{-1} & -[K_2\Delta^{-1}\gamma + (K_1+K_2)^{-1}\gamma\frac{1}{2}] & K_2\Delta^{-1}\gamma\psi & -K_1\Delta^{-1}\gamma\psi \end{bmatrix} \begin{bmatrix} \mu \\ \eta \\ f_1 \\ f_2 \\ \tau_1 - \tau_2 \\ \bar{y}_1 \\ \bar{y}_2 \end{bmatrix}$$

$$(26a) \quad K_1 = 1 + \gamma \left(\frac{1}{2} k \lambda^{-1} - \psi \right)$$

$$(26b) \quad K_2 = \frac{1}{2} \gamma k \lambda^{-1} - \epsilon$$

$$(26c) \quad \Delta = K_1^2 - K_2^2 = (K_1 + K_2)(K_1 - K_2)$$

Several points can be made about the fixed exchange rate system. First, stability requires that $K_1 + K_2 > 0$ and that $K_1 - K_2 > 0$. This is equivalent to requiring that $K_1 > 0$ and $\Delta > 0$. However, K_2 could be either positive or negative. With a fixed exchange rate, fiscal contraction in the United States will therefore definitely lower U.S. real output (from (25) $\frac{\partial y_1}{\partial f_1} = K_1 \Delta^{-1} > 0$) but it may either raise or lower real output in the ROW ($\frac{\partial y_2}{\partial f_1} = -K_2 \Delta^{-1}$). If $K_2 < 0$, the depressing effect on the ROW's export sector of a decline in U.S. demand outweighs the beneficial effect of lower worldwide interest rates ($\epsilon > \frac{1}{2} \gamma k \lambda^{-1}$ in 26b) and the ROW experiences a slump. If the "crowding in" effect is stronger than the direct demand effect, ($K_2 > 0$) then the ROW expands while the U.S. contracts. Even if output in both countries declines, the decline will be steeper in the United States.

It is easily checked that, if the U.S. and ROW are of similar size, total world output always contracts, even in the case where output in the ROW is stimulated by lower interest rates:

$$(27) \quad y^a = (K_1 + K_2)^{-1} \gamma \lambda^{-1} \frac{\ell}{2} + (K_1 + K_2)^{-1} \gamma \mu - (K_1 + K_2)^{-1} \gamma \lambda^{-1} \eta \\ + (K_1 + K_2)^{-1} f^a - (K_1 + K_2)^{-1} \gamma \psi \bar{y}^a$$

Note that average global real liquidity under the fixed exchange rate regime ($1/2 \lambda$ given in equation (24)) behaves identically to average global real liquidity under the freely floating exchange rate regime (1^a given in equation 14(b)). 1/ The same holds for average world output. (Compare equation (27) with y^a from equation (15b)). It is also checked very easily that the long-run, steady state effects of fiscal policy (or other real shocks) are the same under fixed and floating rates.

When therefore we compare the consequences of a tightening of U.S. fiscal policy under a floating exchange rate with that under a fixed exchange rate, holding global monetary policy constant in the sense that the growth rates of domestic credit (and therefore the growth rate of the global stock of nominal money) are the same in the two regimes, the recession in the U.S. following the fiscal contraction will be smaller under a floating exchange rate while in the ROW the recession will be deeper with a floating rate.

The global loss of output is the same under the two exchange rate regimes, but while under a floating rate the recessions in the U.S. and the ROW are identical in magnitude (although in the U.S. the non-traded goods sector will be hit while in the ROW it will be the traded goods sector), under a fixed rate the U.S. will always experience a deeper recession. It is even possible that under a fixed rate the ROW would experience a net boost to output.

1/ Since $K_1 + K_2 = \Omega - \epsilon$.

The short-run behavior of the real exchange rate is quite different under the two regimes. As shown in Figure 3, under a floating exchange rate U.S. competitiveness, which is a non-predetermined variable in this case, sharply improves on impact to its new equilibrium level. This jump-depreciation of c reflects a jump-depreciation of e , the nominal exchange rate. While this clearly represents a hard landing for the U.S. dollar, it represents a much softer landing for the U.S. real economy than the alternative scenario where the nominal exchange rate is kept constant throughout. In the latter case U.S. competitiveness improves gradually after the U.S. fiscal contraction and converges asymptotically to the same level achieved immediately with a freely floating exchange rate. The improvement in competitiveness is due to the U.S. rate of cost inflation falling below that in the ROW because of the relatively deeper recession in the U.S.

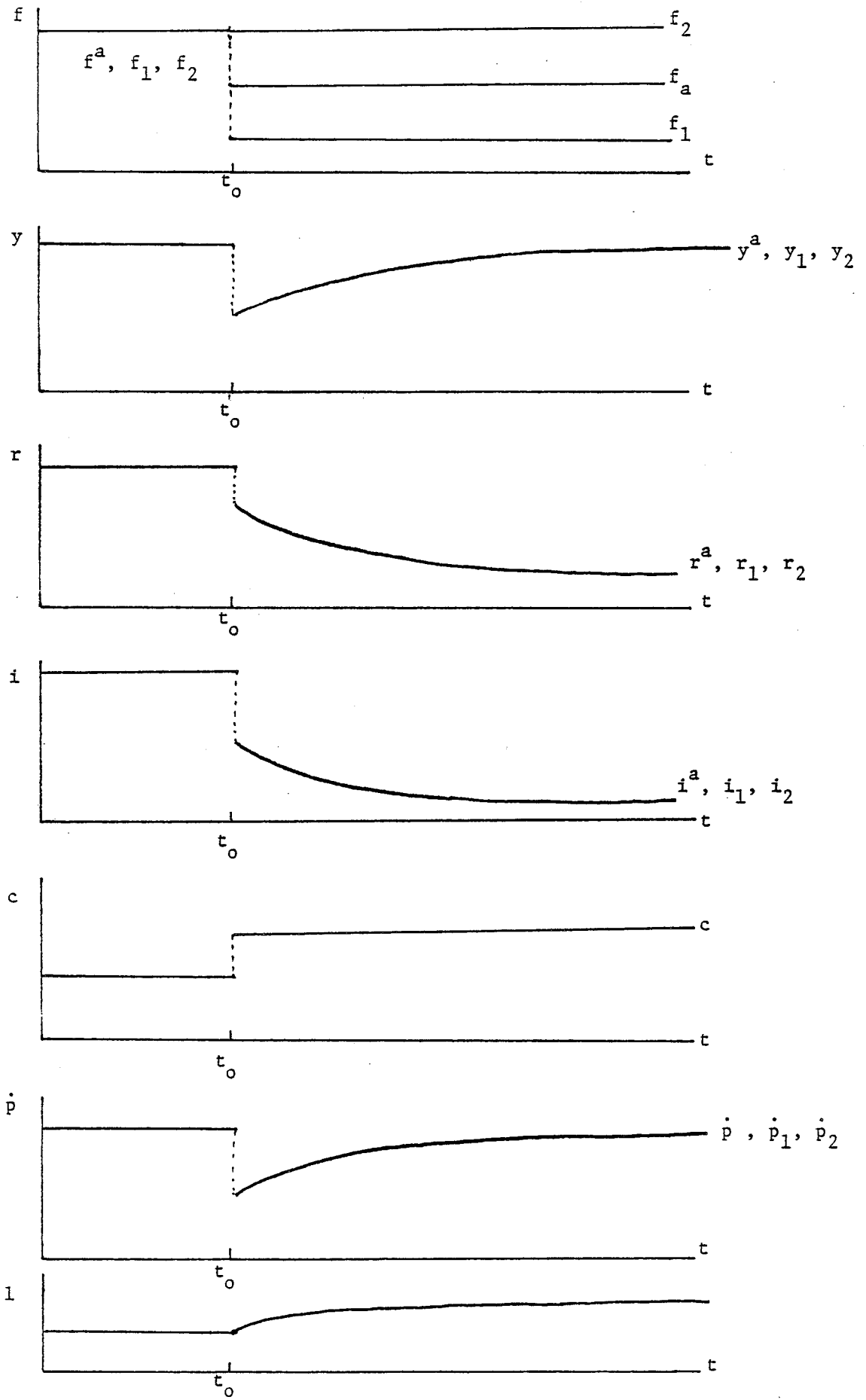
III.3 Policies that achieve an improvement in U.S. competitiveness without a contraction of world demand

In this subsection I take as given the fiscal tightening in the United States as well as the achievement of a lasting improvement in U.S. external competitiveness. A floating exchange rate is again assumed.

A ROW fiscal expansion to match the U.S. fiscal contraction

In the formal setting of our little model, the transition to improved U.S. competitiveness can be achieved instantaneously and without any contraction of effective demand at home or abroad by having the U.S. fiscal contraction matched by a corresponding ROW fiscal expansion. In

Figure 3
 Global and Regional Response to a Unilateral
 Tightening of U.S. fiscal Policy



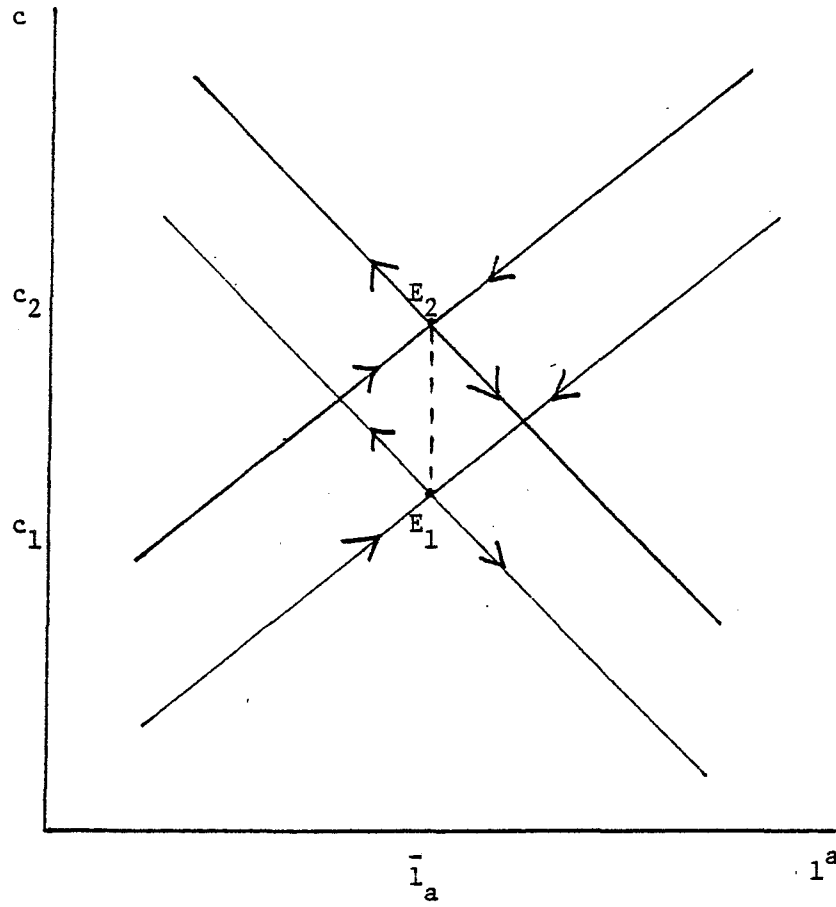
terms of the dynamics of equations (14a,b) and (15a,b) and the steady-state conditions of equations (16a-e), this "package" consists of a reduction in f^d with f^a unchanged. Figure 4 shows the instantaneous adjustment process.

There is no change in real or nominal interest rates as the effects on the global capital market of the two opposing fiscal impulses cancel each other out. For a given U.S. fiscal contraction, the improvement in U.S. competitiveness is now doubled (in our linear model) because of the fiscal expansion in the ROW. World aggregate demand is unchanged and so is aggregate demand for each individual country's output.

There are several qualifications to be made before this painless adjustment package is recommended for use in the real world. First, while total output stays constant in each country, there is a shift towards the production of tradeables in the U.S. and towards the production of nontradeables in the ROW. Steelworkers make poor hairdressers and conversely. The problems associated with changing the sectoral composition of production, employment and investment are ignored in our simple model.

Second, the selection of dosage and timing for the ROW fiscal expansion is made to look simpler than it is in practice because of the assumption of known, identical structures. While this in no way weakens the case for a flexible policy response in principle, it makes the practical task of selecting the right mix, dose and timing a much more complicated matter than our simple model may suggest.

Figure 4



Response to a U.S. fiscal contraction and a matching ROW fiscal expansion.

Third, a fiscal expansion in the ROW may be opposed for structural or allocative reasons. Increased public spending may be undesirable because of its political irreversibility and because, at full employment, the benefits from the spending are judged to be less than its cost. Lower taxes or higher transfer payments may be undesirable because of possible efficiency losses, undesirable incentive effects or for distributional reasons.

Fourth, fiscal expansions (other than balanced-budget fiscal expansions) entail larger deficits and, in time, a larger public debt. If the real interest rate exceeds the growth rate of the real tax base, explosive debt-deficit spirals are possible unless the primary (non-interest) deficit is planned (and believed) to become a surplus in due course. If there is no reputation for fiscal rectitude, temporary (increases in) deficits will be extrapolated into the future. Fear of possible future monetization of deficits will raise long nominal interest rates. Increased uncertainty about the future course of inflation may add a further risk premium to the required rate of return on nominal government debt. In extreme circumstances, fear of partial or complete debt repudiation or of special capital levies and surcharges may build a risk premium into the rate of return on all public debt (See Blanchard, Buiter and Dornbusch [1984] and Buiter [1985b]). A good reputation for underlying fiscal rectitude would, however, avoid the potential crowding out resulting from such confidence effects. It might therefore help if such a program were supervised by or at least coordinated through an organization such as the IMF whose reputation for fiscal restraint is second to none.

Finally, it may be judged that the global level of effective demand is currently excessive, and that a net reduction in global demand is in order, as well as a realignment of U.S. competitiveness. A unilateral U.S. fiscal contraction might in that case be the right policy. The point would seem to be mainly of academic interest, as in the opinion of most observers there remains a margin of Keynesian slack in the world economy.

A U.S. fiscal contraction matched by effective demand-maintaining expansionary monetary policy changes

Calls for a change in the U.S. macroeconomic policy mix, from tight money and loose fiscal policy to looser money and tighter fiscal policy have been heard from all corners of the profession in recent years. There are two kinds of monetary policy changes that could be used in the present model: changes in level of the nominal money stock and changes in the proportional growth rate of the nominal money stock.

Money "jumps"

It is clear from inspection of the steady state conditions (16a, e) and the equations of motion (14a, b) and (15a, b) that there is one and only set of discrete (discontinuous) changes in the levels of the nominal money stocks in both countries that will permit an instantaneous transition at full employment (in both countries) to the new real long run equilibrium associated with the unilateral reduction in the U.S. fiscal impulse discussed in Section III.1. If $df_1 < 0$ is the size of the U.S. fiscal contraction, these nominal money jumps in both countries are given by

$$(28) \quad dm_1 = dm_2 = - \frac{\lambda}{2\gamma} df_1$$

At the predetermined price level, this nominal money jump provides just the right increase in real money balances demanded as a result of the lower nominal (and real) world interest rate associated with the lower global fiscal impulse. There is no need to force the price level path below the nominal money stock path through a policy of demand deflation and unemployment. The steady state increase in real money balances which in a new-classical model with a non-predetermined, flexible price level would be brought about by a discrete downward jump in the price level path, is achieved in the Keynesian, predetermined price level model by a stock-shift open market purchase in each country which increases the nominal money stocks by the required amounts. It is the stickiness of real money balances which makes a recession inevitable when there is any exogenous shock or policy change which raises the long-run demand for money balances. This stickiness of the real money stock reflects both the stickiness of domestic costs (assumed to be a policy- and exogenous shock-invariant structural property of private market behavior), and the stickiness of monetary policy. If the level of the nominal money stock is a choice variable at any given instant, policy flexibility can make up for and compensate for domestic cost inflexibility.

The great advantage of the kind of once-and-for-all nominal money stock jumps considered here is that they don't result in any change in the rate of inflation, short run or long run. They do cause the long-run level of the path of prices to be higher than it would otherwise have

been, but since welfare costs are associated with the rate of inflation rather than with the level of prices, 1/ this is no cause for concern. The major problem with money jump policies is their effect on inflationary expectations. The obvious analytical distinction between a discontinuous discrete change in the level of the money stock path and a (finite) change in the instantaneous rate of change of that path may not be as obvious in practice, especially when the money stock path is sampled at discrete time intervals: a once-and-for-all upward level change at a point in time in the middle of an observation interval t_0 may look much like an increase in the rate of growth between t_0 and $t_0 + 1$. If such an apparent increase in the growth rate gets extrapolated into the future, serious instability may result. Governments or central banks with a reputation for monetary rectitude will be able to engineer once-off money jumps without adverse effects on inflationary expectations. Governments or central banks with a reputation for monetary laxness will be prisoners of the markets' lack of confidence and may have to live with the adverse effects on inflation expectations of any observed increase in the money stock.

Note that if the monetary authorities had nominal income targets rather than monetary targets, there should be no credibility problems associated with a once-off increase in the nominal money stock. Nominal

1/ The statement is meant to apply to a world without uncertainty only.

income targets are velocity-corrected monetary targets. They have desirable operating characteristics whenever exogenous shocks or policy changes necessitate a change in velocity.

Changes in money growth rates

The other monetary policy action (in both countries) that can achieve the transition to an improved level of U.S. competitiveness without any output or employment cost is an equal permanent increase in the rate of growth of the nominal money stock in each country. It can again be checked from the steady-state conditions (16a) - (16e) and from the equations of motion (14a, b) and (15a, b) that the following permanent increase in \dot{m}_1 and \dot{m}_2 will achieve an instantaneous transition at full employment (in both countries) to the new real long-run equilibrium associated with the unilateral reduction in the U.S. fiscal impulse discussed in Section III.1.

$$(29) \quad \dot{dm}_1 = \dot{dm}_2 = -\frac{1}{2\gamma} df^1$$

This monetary policy response would, by raising the rate of inflation in both countries, prevent the global real interest rate decline resulting from the U.S. fiscal contraction from being translated into a decline in nominal interest rates. With nominal interest rates unchanged, there is no increase in the demand for real money balances and consequently no need for a recession to depress the general price level path below the nominal money stock path. The policy has one obvious undesirable feature: a recession is prevented at the cost of having a permanently higher rate of inflation in the world economy.

IV. Responses to a Collapse of the U.S. Dollar

A second question addressed by economic policy makers and analysts is the proper response (in the U.S. and in the ROW) to a sudden large fall in the value of a key currency, taken to be the U.S. dollar for concreteness in this paper. To determine the nature of the appropriate policy responses, we first must determine what the causes of the sudden depreciation of the currency are. There are two broad classes of possible causes: (a) the bursting of a speculative bubble that had caused the dollar to be overvalued in relation to the "fundamentals." (b) an actual or perceived change in the fundamentals driving the exchange rate. The latter category can be subdivided into a number of cases. (1) a portfolio shift against the dollar reflecting, say, greater uncertainty about the future prospects for U.S. inflation. In the simple model of this paper, this can be represented by a reduction in U.S. liquidity preference: a fall in η_1 ; (2) an increase in the real risk premium on foreign-owned U.S. assets. This could reflect fear of future increases in taxation of U.S. interest income and, conceivably, a greater perceived risk of repudiation or default. In the model this can be represented by an increase in $\tau_2 - \tau_1$: the real risk premium is like a net tax on U.S. interest income; (3) an unexpected increase in the level of the U.S. money stock or in the rate of U.S. monetary growth; (4) an unexpected tightening of the U.S. fiscal stance.

All four events should be thought of in relative terms, e.g., the portfolio shift against the dollar reflects an increase in uncertainty about U.S. inflation relative to uncertainty about inflation in the rest

of the world. Similarly, it is looser U.S. monetary policy relative to monetary policy elsewhere or tighter U.S. fiscal policy relative to fiscal policy elsewhere that puts downward pressure on the dollar.

An important issue in determining the appropriate policy response to a sudden drop of the dollar in response to a change in private sector perceptions concerning the likely future course of the fundamentals, is whether the national authorities and the international coordinating agency share these new perceptions. A different approach will in general be called for if the authorities believe they have information superior to that used by private agents in forming expectations, but there is no way of sharing this information with private market participants or of convincing them of its relevance. In what follows, no superior public sector information is assumed.

1. A bursting bubble

It is well-known that the solution of rational expectations models with forward-looking, non-predetermined state variables (such as the nominal and the real exchange rate in our model) may be characterized by a bubble; that is, the behavior of the endogenous variables may be influenced by variables that matter only because, somehow, private agents believe that they matter. These bubble processes, which affect expectations in a self-validating manner, may be functions of the fundamental variables (i.e. those variables that enter into the structure of the model other than merely by being part of the information set used to form

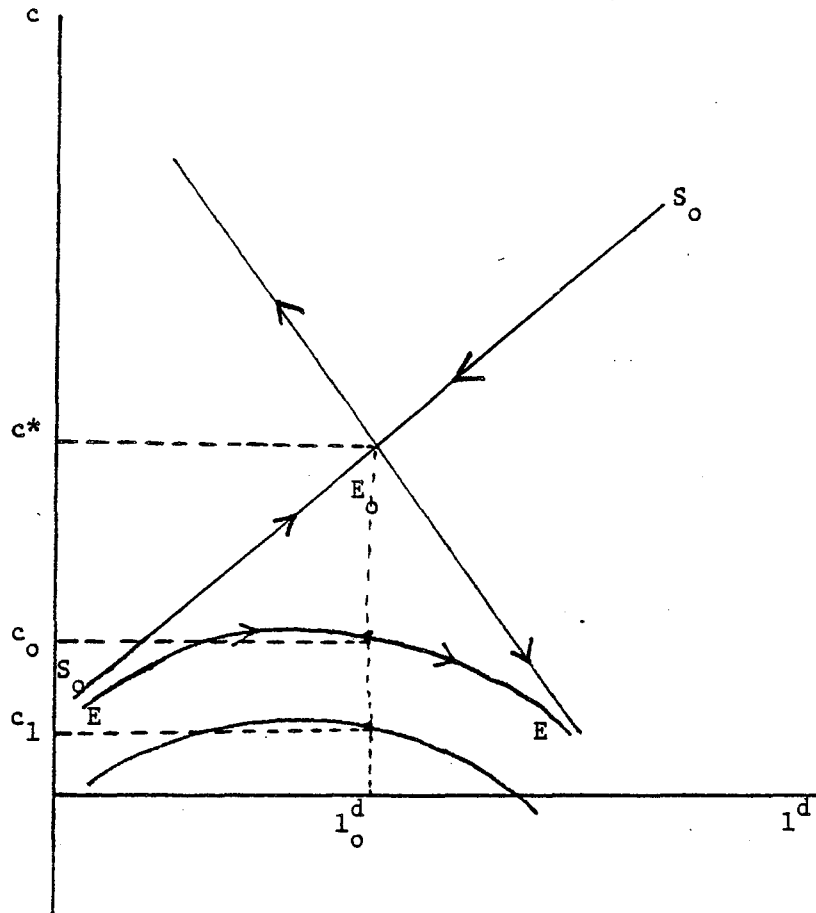
expectations) or of completely extraneous or spurious variables of the "sunspot" variety (Blanchard (79); Azariadis [1981], Obstfeld and Rogoff [1983]). In Figure 5, it is assumed that all "fundamentals" have constant values, now and in the future, that the steady state equilibrium corresponding to these constant values for the fundamentals is E_0 and that the associated convergent saddle path is S_0S_0 . Suppose, without loss of generality, that the predetermined variable is at its steady-state value ℓ_0^d . The non-predetermined variable, c , however, is on a bubble path EE which overvalues it relative to the path warranted by the fundamentals (S_0S_0). Its value at t_0 , the time the bubble bursts is c_0 . The bursting of the bubble moves c instantaneously to its fundamental value c^* . In a rational world, there must be uncertainty about the direction of the discrete jump in the exchange rate at t_0 . The instantaneous discrete upward jump in c and e would, if it were anticipated with certainty, promise an infinite rate of return to shorting the dollar the instant before t_0 . There could however be a set of beliefs which at t_0 , attaches some probability Π_0 to a return to the fundamental value ($\Delta c = c^* - c_0$) and some probability $1 - \Pi_0$ to a further discrete downward jump in c to c_1 which puts the exchange rate on a bubble path even further removed from its fundamental value. Provided $\Pi_0(c^* - c_0) + (1 - \Pi_0)(c_1 - c_0) = 0$ there are no expected excess returns from taking an open currency position. 1/ It seems quite self-evident that the right

1/ The behavior of ℓ^d and C given in equation (14a) can be summarized

$$\begin{bmatrix} \dot{\ell} \\ E_t \dot{c} \end{bmatrix} = A \begin{bmatrix} \ell \\ c \end{bmatrix} + Bz$$

(To be continued on page 30.)

Figure 5
The End of an Exchange Rate Bubble



thing to do for policymakers when a bubble bursts is to sit back and enjoy the sight. While we don't have a well-developed theory of the welfare economics of speculative bubbles in a world with uncertainty, limited and asymmetrically distributed (insider/outsider) information, there is a strong presumption that they are costly and harmful as well as unsustainable. It may be that the fundamental valuation to which the

1/ (Continued from page 29)

where $A \equiv \{a_{ij}\}$, $B = \{b_{ij}\}$ and z is the vector of exogenous variables.

The General solution for c and l can be shown to be (Buiter [1984a])

$$c(t) = -W_{22}^{-1}W_{21}l^d(t) - W_{22}^{-1} \int_t^{\infty} e^{\lambda_2(t-\tau)} DE_{\tau}z(\tau)d\tau + W_{22}^{-1} F(t)$$

$$l^d(t) = e^{\lambda_1(t-t_0)} l^d(t_0) + \int_{t_0}^t e^{\lambda_1(t-s)} b_1 z(s) ds$$

$$- \int_{t_0}^t e^{\lambda_1(t-s)} a_{12} W_{22}^{-1} \int_s^{\infty} e^{\lambda_2(s-\tau)} DE_{\tau}z(\tau) d\tau ds$$

$$+ \int_{t_0}^t e^{\lambda_1(t-s)} a_{12} W_{22}^{-1} F(s) ds$$

λ_1 is the stable eigenvalue of A and λ_2 the unstable eigenvalue.

$$\begin{bmatrix} W_{11} & W_{12} \\ W_{21} & W_{22} \end{bmatrix} = W = V^{-1} \text{ where } V \text{ is the matrix whose columns are the right}$$

$$\text{eigenvectors of } A. \quad D = [W_{21}b_1 + W_{22}b_2] \cdot \begin{bmatrix} b_1 \\ b_2 \end{bmatrix} = B.$$

F is the bubble component. It satisfies $E_{\tau} \dot{F}(t) = \lambda_2 F(t)$ but is otherwise arbitrary.

exchange rate returns when the bubble bursts, itself represents an unattractive equilibrium because the fundamentals (especially current and anticipated future policy) are in a mess. That, however, is an argument for doing something about the fundamentals, when the exchange rate once again reflects those fundamentals, which would have been desirable even if there had been no bubble and no sudden drop in the exchange value of the dollar.

In reality, the ending of a speculative bubble is likely to be associated both with major redistributions of wealth and with short-term disruption of financial markets, commerce and production because of bankruptcies and insolvencies. None of these adjustment costs are included in our formal model. I would be surprised, nevertheless, if it could be shown that it is better to end a bubble with a slow puncture than with a quick burst. A hard landing of the dollar under these circumstances does not preclude a soft landing for the world economy. No policy response in the U.S. or in the ROW seems necessary.

2. A reduction in U.S. liquidity preference

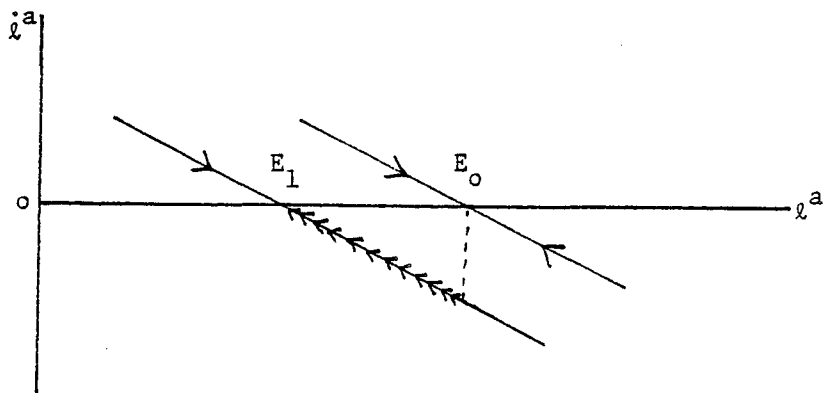
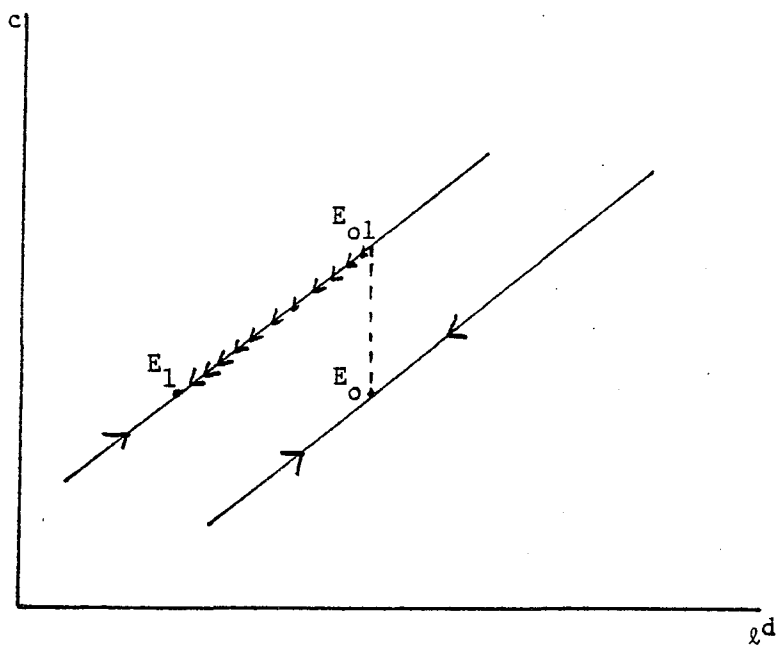
A downward shift in the U.S. liquidity preference schedule (a fall in η_1) has no long run effects on competitiveness or on real or nominal interest rates. In the short run, the effects are as depicted in Figure 6. An unexpected, immediate, permanent reduction in η_1 works just like a once-off increase in the level of the U.S. money stock. The nominal and real exchange rate jump-depreciates to E_{01} from E_0 . After that the real exchange rate gradually moves back to its initial level and the system converges to E_1 . In the U.S. real economic activity booms because of

short-run lower nominal and real interest rates and because of the improvement in competitiveness. Average world economic activity also rises (y^a increases) because of the short-run downward pressure on nominal and real interest rates. Activity levels in the ROW are, however, depressed, as the loss of competitiveness outweighs the effect of lower interest rates. If the initial equilibrium was deemed satisfactory, the obvious policy response to the fall in liquidity preference is a matching once-off reduction in the level of the U.S. nominal money stock. This would leave all real and nominal variables (other than l_1) unchanged.

If the shift out of U.S. money represents stock-shift currency substitution and has as its counterpart a matching stock-shift increase in foreign money demand η_2 , the change in competitiveness will be twice as large. Average real world activity (y^a , i^a , p^a and r^a) are unchanged in the short run and in the long run. The behavior of c and l^d is like that illustrated in the top diagram of Figure 6, but with a shift up and to the left of the saddlepath that is twice as large. The U.S. experiences a transitional boom that is matched by a transitional slump in the ROW. The obvious way to neutralize this once-off currency substitution and stabilize the exchange rate is to contract the U.S. money stock by $-\Delta\eta_1$ and expand the ROW money stock by $\Delta\eta_2$. Such monetary policy changes in addition may well have favorable effects (not formally modelled here) on the relative changes in inflation uncertainty that may have prompted the money demand shifts in the first place.

Figure 6

Dollar Depreciation as a Result of a Fall in U.S. Liquidity Preference



An increase in the real U.S. risk premium

An increase in the relative perceived real riskiness of foreign investment in the U.S. will in the long run raise the U.S. real and nominal interest rates and lower the ROW real and nominal interest rates, leaving the average world rates unchanged. The increase in U.S. riskiness and reduction in ROW riskiness are assumed to apply only to foreign investors, not to domestic capital formation in either country. Figure 7 illustrates the dynamic response pattern to this shock. Global averages (l^a , y^a , i^a , p^a and r^a) are not affected. The U.S. economy experiences an immediate jump-depreciation of the nominal and real exchange rate from E_0 to E_{01} .

Note that the real exchange rate overshoots its long run equilibrium value. After the initial jump there is a gradual depreciation of the U.S. real exchange rate. The new long-run equilibrium at E_1 represents a net real depreciation relative to the initial one. The U.S. economy experiences a transitory boom which lowers its real stock of money balances. The ROW goes through a transitory slump which raises its real money balances.

One possible policy response that exactly neutralizes this increase in the U.S. foreign investment risk premium is an equal increase in $\tau_1 - \tau_2$, the excess of the U.S. tax rate on interest income accruing from abroad over the ROW's tax rate on interest income accruing from the United States. This would restore the initial equilibrium immediately. Alternatively, a

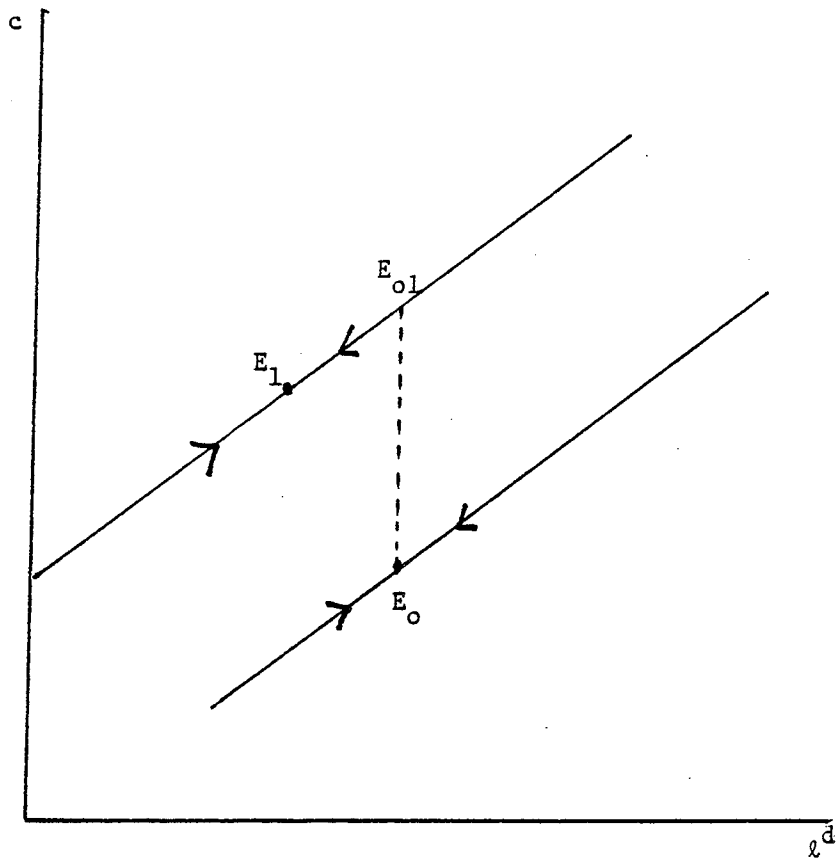


Figure 7

An Increase in the Relative Perceived Riskiness of Foreign Investment in the U.S.

once-off increase in the ROW's nominal money stock by λ times the change in the risk premium and a reduction in the U.S. nominal money stock by the same magnitude, would instantaneously achieve the same long-run change in the real equilibrium shown in Figure 7, without any transitional U.S. inflation and ROW contraction. A permanent increase in the U.S.'s rate of monetary growth and an equal reduction in the ROW's rate of monetary growth with $\dot{dm}_1 - \dot{dm}_2 \equiv \dot{dm}^d = -d(\text{risk premium})$ would, in Figure 7, move the economy immediately from E_0 to E_{01} , which would now be the new long-run equilibrium.

Policy-induced exchange rate collapses

The response of the exchange rate to changes in fiscal and monetary policy in the United States and ROW has already been discussed in Section III. The only point worth repeating here is that a "hard landing" for the U.S. dollar need not represent a hard landing for the U.S. economy or for the ROW. If the initial situation is one characterized by current and anticipated future lax U.S. fiscal policy and tight U.S. monetary policy, these fundamentals are likely to be reflected in a strong (an "overvalued") U.S. real exchange rate. The first-best cooperative, coordinated global policy package to change this unfavorable equilibrium (fiscal contraction in the U.S., once-off money stock increases in the U.S. and the ROW to meet the resulting fall in velocity) is accompanied by a dollar "collapse." It may seem paradoxical that the restoration of confidence in the ability of the U.S. to get and keep its budget under control,

would be accompanied by a fall in the U.S. dollar, but such a view reflects the mistaken identification of the exchange rate as an index of national economic macho.

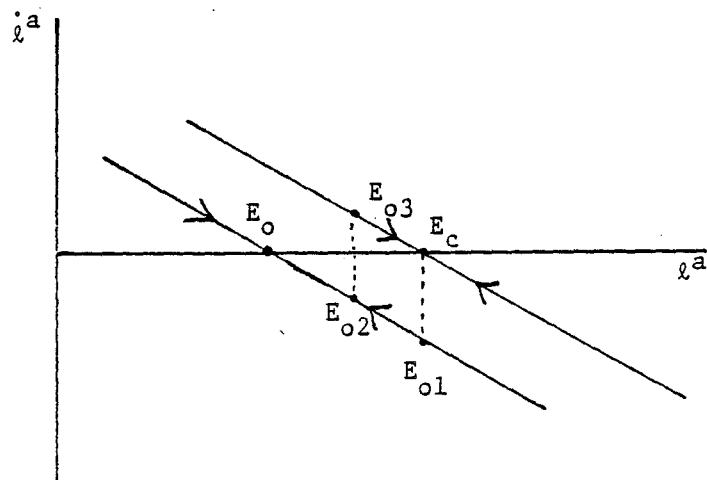
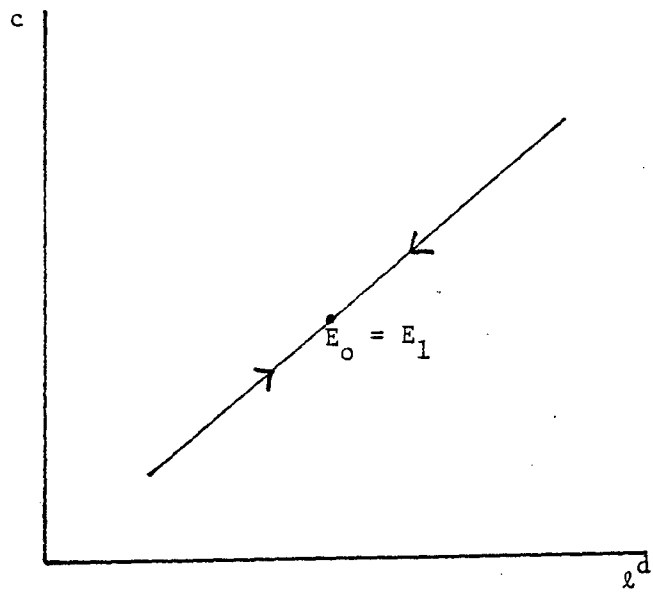
V. Policy Responses to a Slowdown in Global Economic Activity

The first question that needs to be answered before one can determine the appropriate U.S. and ROW policy responses to a global economic slowdown concerns the cause(s) of this slowdown. A distinction must be made between a slowdown resulting from an adverse supply-side shock (modeled in our simple model by a temporary or permanent fall in \bar{y}_1 or \bar{y}_2) and a demand-induced slowdown. Among the latter we can again distinguish adverse money demand shocks (increases in η_1 and η_2) and reductions in private U.S. or ROW demand for goods and services (which can be represented as reductions in f_1 or f_2).

Adverse supply-side developments

Permanent reductions in productive capacity in the U.S. and the ROW raise the long-run real interest rate everywhere and thus bring demand down in line with supply. Nominal interest rates will also rise if money growth rates are unaffected and, both through real income and interest rate effects, the demand for real money balances in both regions will decline in the long run. If productive capacity is affected equally in both countries ($\Delta\bar{y}_1 = \Delta\bar{y}_2 = \Delta\bar{y}$) there is no long-run change in l^d or on c. In this case, as shown in Figure 8, the world economy undergoes a bout of excess demand and inflation in excess of the rate of monetary growth

Figure 8
 Effects of a Common Permanent Decline in Productive Capacity
 in Both Countries



(affecting both regions equally) which in the long run lowers the long-run stock of money balances. In the very short run, output (which is demand-determined) actually rises because higher inflation reduces the real interest rate (nominal interest rates rise less than one-for-one with the rate of inflation because the LM curve is not vertical).

The policy response that prevents the emergence of excess demand and inflationary pressures during the transition to the lower levels of capacity output, involves a contraction of demand which can be achieved either by fiscal or monetary means (or by a combination of the two). If no long-run change in competitiveness is desired, any fiscal contraction should be equal in the two countries. Probably the simplest coordinated policy action that achieves the new long-run equilibrium at E_1 in Figure 8 immediately, is a reduction in m_1 and in m_2 equal to $(k + \frac{\lambda(1-\epsilon)}{\gamma})\Delta\bar{y}$.

If the common capacity decline at t_0 is expected to be temporary and to be reversed at t_1 , there is still no action in $c-1^d$ space (the top diagram in Figure 8). The world economy experiences a bout of excess demand between t_0 and t_1 (moving from E_{01} to E_{02}) and a bout of excess supply after t_1 (between E_{03} and E_0). The same reduction in m_1 and in m_2 at t_0 will take the world economy (without excess demand) from E_0 to E_1 where it will stay until t_1 . At t_1 both nominal money stocks should be increased again by the same percentage by which they were reduced at t_0 in order to achieve a painless and instantaneous restoration of full equilibrium at E_1 .

An adverse permanent supply shock in the United States alone, say, would cause a long-run worsening of the U.S. competitiveness (required to choke off global demand for U.S. output), some increase in global real and nominal interest rates (but less than with a common decline in capacity output), a decline in U.S. real money balances and a smaller decline in ROW real money balances. On impact, there is likely to be a step appreciation of the dollar. After that the real exchange rate continues to appreciate gradually towards its new long-run equilibrium. Real interest rates in the United States will be below those in the ROW during the transition. A reduction in the U.S. nominal money stock by an amount

$$\left(k + \frac{\lambda(1-\epsilon)}{\gamma}\right)\Delta\bar{y}_1$$

and an increase in the ROW nominal money stock by

$$-\frac{\lambda(1-\epsilon)}{\gamma}\Delta\bar{y}_1$$

will permit an instantaneous transition to the new real long-run equilibrium with lower values of c , l^d , and l^a , avoiding the transitory inflation in the United States and the transitory contraction in the ROW that would otherwise occur.

A demand-induced slowdown in economic activity

When the cause of a disappointing level of economic activity is a decline in some component of private demand, appropriately designed demand management can minimize the damage and, in the present model, can be used to avoid it altogether. Increases in private liquidity preference

(η_1 and η_2) can be met with corresponding once-off increases in the levels of the nominal money stocks— m_1 and m_2 . A downward shift in the private consumption functions or a collapse of animal spirits can be offset directly by corresponding fiscal stimuli f_1 and f_2 . If the balanced budget multiplier theorem retains some validity, these fiscal stimuli can be provided without increasing the deficit. Supply-side consequences from the tax increase or transfer payments cuts involved in a balanced-budget expansion should of course be taken into account (the behavioral links, ignored in this paper, between f_1 and \bar{y}_1).

Note that it is never necessary, in response to any shock, to engineer a permanent change in monetary growth rates. Once-off changes in the levels of the nominal money stocks (or temporary changes in money growth rates) are sufficient.

VI. Conclusion

This paper presents a rather old-fashioned study of demand management in an open, interdependent economic system. Three contingencies discussed in the September 1985 World Economic Outlook were analyzed using an eclectic, short-run Keynesian, long-run classical, two-country model. The main conclusion is that an active monetary and/or fiscal response in both countries or regions is in general required to minimize the costs associated with the adjustment process resulting from a variety of demand-side or supply-side shocks. One exception to this rule is the case of a currency collapse resulting from the bursting of an exchange market speculative bubble.

A unilateral U.S. fiscal contradiction will cause a temporary slowdown of world economic activity as well as a sudden drop in the nominal and real value of the dollar. Merely preventing the nominal exchange rate from changing does not reduce the magnitude of the global recession or alter the long-run real adjustment that takes place, but it would redistribute the unchanged global unemployment and excess capacity burden towards the United States and away from the ROW. A no-response policy would be consistent with the achievement of improved U.S. competitiveness at full employment if the initial situation were characterized not only by a U.S. fiscal-monetary policy mix that is biased towards fiscal expansion and monetary tightness, resulting in a poor U.S. international competitive position, but also by global excess demand. An expansionary fiscal move in the ROW or a combined expansionary monetary policy move in both the United States and the ROW or a combined expansionary monetary policy move in both the United States and the ROW could achieve the desired traverse to a better level of U.S. competitiveness without a global slump. These monetary stimuli need not be permanent increases in the rate of money growth. Once-off credible open market purchases raising the levels of the nominal money stocks suffice.

The stabilizing policy response to a sudden drop in the value of the dollar depends crucially on the reason(s) for this drop. The bursting of a speculative bubble has no obvious monetary or fiscal policy implication. Downward pressure on the value of the dollar resulting from a once-off fall in U.S. liquidity preference calls for a matching once-off reduction in the U.S. nominal money stock. Direct currency substitution away from

the dollar calls for open market sales in the United States and open market purchases in the ROW. The consequences of the emergence of a real risk premium on the return from foreign investment in the United States can be neutralized by a matching increase in the difference between the U.S. tax rate on interest income from the ROW and the ROW's tax rate on interest income from the United States. Alternatively, one might accept the depreciation of the nominal and real U.S. exchange rates but avoid the transitional U.S. inflation and ROW contraction by expanding the money stock in the ROW and reducing it in the United States.

The stabilizing policy response to a slowdown in global economic activity depends on whether this slowdown reflects a deterioration of the supply side or deficient aggregate demand. To avoid the stagflation that would otherwise result from a global adverse supply shock, demand-reducing measures are called for in both countries. If the supply shock is temporary, the restrictive measures can be reversed when capacity output recovers, thus maintaining capacity output. The stabilizing response to a fall in private demand for goods and services is a fiscal stimulus. The contractionary effects of an increase in liquidity preference can be avoided by an accommodating (non-inflationary) increase in the level of the money stock.

The fiscal stimuli discussed in this paper are to be interpreted as "discretionary" changes over and above the automatic changes in tax receipts and transfer payments that reflect the workings of existing tax and benefit laws, rules, and regulations as the level of economic activity varies, and that may dampen but never eliminate such fluctuations.

To provide truly satisfactory answers to the questions raised in the WEO the model of this paper would have to be extended in a number of directions. The WEO approaches the macroeconomic issues of the industrialized world in a three-region setting: the United States; Europe; and Japan plus Canada. The complexity entailed in going to three regions virtually obliges one to use numerical rather than analytical methods. The model of this paper ignores all stock-flow asset dynamics, those coming from the government budget identities, those coming from the current account of the balance of payments, and those resulting from real capital accumulation. 1/ Again, their incorporation requires the use of numerical methods. Finally, it would be extremely desirable to allow explicitly for uncertainty. Adding some linear stochastic processes with known coefficients to the deterministic model is feasible but does not constitute much of an advance. Anything more complicated, even linear models with stochastic coefficients, let alone non-linear stochastic models, means that we enter the mathematical or computational stratosphere. The modelling language we would like to use just does not exist yet.

The logic of the model used in this paper, and indeed of any model that permits persistent disequilibrium or non-Walrasian equilibrium is that monetary and fiscal policy instruments can be used actively to stabilize output, employment, and the price level in response to a whole

1/ For a numerical simulation model which incorporates all three sources of asset dynamics in a two-country, full employment setting, see Buiter (1984b).

range of demand or supply shocks. To argue against such active policy responses, or against the adoption of explicit policy rules that would, e.g., make monetary growth (or the deviation of actual monetary growth from its expected value) a function of observable contingencies, a case must be made for the technical, political or institutional impossibility of an active stabilization policy.

The technical impossibility of stabilization policy has been argued on two grounds. There is the Lucas-Sargent-Wallace-Barro argument that in properly specified macroeconomic models, only unperceived or unanticipated monetary policy can affect the deviations of actual real variables from their "natural" or full information values. Fiscal policy obviously has allocative effects both in the short run and in the long run, but it too cannot systematically affect the deviation of real output and employment from their capacity, full employment, or natural levels. If debt neutrality prevails, the substitution of lump-sum taxes for current borrowing has no real effects in the short run or in the long run. These policy ineffectiveness propositions for a while engaged the interest of a significant part of the macroeconomics profession but are now generally viewed as theoretical *curiosa* without empirical relevance.

The second technical argument against the active use of stabilization policy is much older (it goes back at least to Milton Friedman's work in the fifties and sixties) but more relevant. It is a generalization of the "long and variable lags" argument used by Friedman to make the case

against active countercyclical use of monetary policy. Clearly, the length of the lag between the policy response and its impact on the variable(s) of interest (the "outside" lag) is irrelevant per se. It is uncertainty about the coefficients in the model, about the order of the lags and indeed about the total specification of the appropriate model of the economy, that forces one to qualify the confident policy prescriptives that emerge from the manipulation of models such as the one in this paper. The length of the "inside lag," the lag between the identification of the need to respond and the moment the policy handle can finally be cranked, puts further constraints on our ability to stabilize the economy through active demand management. Estimates of the "inside lag" for U.S. fiscal policy range from a few years to infinity.

It should be recognized that uncertainty about the way in which the economy works not only renders the consequences of policy activism harder to predict. It also increases uncertainty about the consequences of refraining from policy activism and sticking to preannounced, unconditional (non-contingent or open-loop) rules. It seems highly unlikely that a cautious, safety-first policy of hedging one's bets in the face of great uncertainty would ever involve the economic equivalent of locking the steering wheel and closing one's eyes.

The political or institutional case against active demand management in part relies on alleged observed asymmetries or irreversibilities in monetary and fiscal policy design. Policy makers are happy to cut taxes

and raise spending for cyclical reasons during a slump, but are reluctant to raise taxes and cut spending when the economy is overheating and a counter-cyclical quid pro quo is needed. While there is some informal evidence supporting this view, there are counter-examples too (e.g., the increase in the overall British tax burden by 4 percent of GDP during Prime Minister Thatcher's first term). It would be very valuable to have more systematic evidence on this important issue of political economy.

The conditions under which optimal, conditional stabilization policy rules would be credible (or time-consistent) also are only just beginning to be studied. The study of post-World War II economic history suggests that "stabilizing" monetary and fiscal policy actions only have their desired effects if the monetary or fiscal authorities have "conservative" reputations for underlying monetary soundness and fiscal responsibility and rectitude. Without such reputations, temporary and reversible changes in money growth, tax rates, or spending schedules are likely to be perceived as permanent. Such adverse expectations or confidence effects may lead to inflation premia in nominal interest rates, and even to "super-crowding out" or negative multipliers as a result of increased long real rates (see Buiter (1985b)).

International stabilization policy coordination through the IMF, as the world's guardian of sound money and fiscal restraint, could therefore be especially effective. There is in any case no alternative agency with either the prestige or the potential expertise to design a set of workable

macroeconomic policy rules for the world economic community, to argue for their adoption with any chance of even partial success and to monitor compliance and performance. 1/

The global macroeconomic policy recommendations of the current WEO can be summarized as: (1) adherence to unconditional medium-term monetary growth targets; (2) continued downward pressure on structural fiscal deficits; and (3) limited counter-cyclical responsiveness of actual deficits reflecting the partial operation of the automatic fiscal stabilizers. Such a policy package will not prevent a global recession if and when the United States tightens its budgetary stance. It is not even sufficient to prevent the slowdown that appears to be underway already. The risks associated with this strategy are very high. Even in the current state of the arts it is not impossible to design a more flexible and superior set of policy recommendations. Not for the first (or the last) time, caution demands if not action, then certainly being prepared for action should the need arise.

1/ The human and material resources devoted to the study and management of the world economy as a whole at the IMF (i.e., to "surveillance with teeth") are currently very limited, both absolutely and relative to the resources devoted to individual country stabilization programs.

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