1980

Devaluation: Keynesian Trade Models and the Monetary Approach - The Role of Nominal and Real Wage Rigidity

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CENTRE FOR THE STUDY OF INTERNATIONAL ECONOMIC RELATIONS

WORKING PAPER NO. 8016

DEVALUATION: KEYNESIAN TRADE MODELS AND THE MONETARY APPROACH -THE ROLE OF NOMINAL AND REAL WAGE RIGIDITY-

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This paper contains preliminary findings from research work still in progress and should not be quoted without prior approval of the author.

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Revised Version

DEVALUATION : KEYNESIAN TRADE MODELS AND THE MONETARY APPROACH.

- THE ROLE OF NOMINAL AND REAL WAGE RIGIDITY*-

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June 1980

*This work was made possible by a Heisenberg Fellowship of Deutsche Forschungsgemeinschaft, whose aid is gratefully acknowledged. This paper was presented to the Money/Trade Workshop at the University of Western Ontario, February 15, 1980. I would like to thank members of this workshop for discussion and Anthony Reinsch for helping me to make this paper more readable.

1. Introduction

Recently writers concerned with model building in the field of monetary trade theory have become increasingly aware of the important role cost-conditions play in the process of international adjustment. At present two strands of theorizing should be distinguished. Following early work by Salop (1974), among others Argy and Salop (1979), Bilson (1979), Sachs (1979a), Wallich and Gray (1979) address themselves to the problem of how the division between output and price effects of the impact either of domestic policy variables or of some kind of foreign or domestic disturbance is affected by varying degrees of rapid feedthrough from exchange rate changes to output prices. Argy and Salop discuss the efficacy of monetary and fiscal policy under the assumption of after-tax real wage resistance on the part of trade unions. Sachs shows how the Mundell and Fleming results on the efficacy of monetary and fiscal policy in an open economy with capital mobility are totally reversed in the case of fully indexed nominal wages. Bilson, Wallich and Gray set out to construct formal models to pin down the ongoing policy debate over vicious and virtuous circles. While on the one hand not denying this important channel for labor related cost-push inflation, papers by Bruno-Sachs (1979), Dornbusch (1979), Findlay and Rodriguez (1977), Scarth (1979) and Schmid (1979), among others, deal with a direct feedthrough effect of exchange rate changes, for the case of domestic production with a content of imported factors of production the prices of which are denominated in foreign currency units. A unifying feature of all these models is the observation that exchange rate changes, besides their well-known demand effects, may have adverse supply effects. These may be strong enough to make an exchange rate change a neutral or possibly contractionary policy tool in the fight for lower unemployment. Similarly, assuming

a flexible rate system, the problem is now under study as to whether flexible exchange rates may even provide negative insulation against outside shocks like oil and other raw materials' price increases.[1]

This paper aims to contribute to this literature by pointedly asking the question of the efficacy of a devaluation in a model context, which is firstly, rich enough to deal with money and the interrelationship of price and quantity adjustment and secondly, explicitly compliant to the notion that relevant 'open economy monetarism' always should be 'world monetarism'. Therefore

we accept the view of a monetary world economy presented in the volume by Frenkel and Johnson (1976) especially such as given in the paper by Dornbusch contained therein. The reason for picking that article is simply what could be called its incorporation of the 'disequilibrium real balance effect' in international trade models.[2] While we would like to praise Dornbusch's approach for its explicit formulation of the short run 'crowding out' mechanism, he and the main thrust of the literature for the most part have avoided the problem of business cycle propagation with variable outputs hence no reconciliation with more standard Keynesian trade models is provided.[3] Although most certainly there

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[1]This problem among others is analyzed in Schmid (1979).

[2]The expression "disequilibrium real balance effect" is borrowed from Jonson (1976). There the reader will find also a discussion of its closed economy origins, modern theoretical extensions, and related empirical work.

[3]On this ground the Frenkel and Johnson volume was criticized by Hahn (1977). A notable exception is Laidler (1975), Chapters 7 and 9, who presented empirical dynamic models with variable output. However, he omits the income variable from the spending decision which therefore is determined alone by the 'disequilibrium real balance effect'. While Laidler (1980), p. 23, defends this procedure on empirical grounds on the basis of UK data from 1954 to 1970 in a theoretical model it does not seem a fruitful approach.

may exist even more useful alternate routes of attacking that problem,[4] this paper tries a very modest comparative static approach by introducing an explicit neoclassical production bloc to Dornbusch's (1973) one-good, two-country version of the monetary approach. Looking also at the labor market more closely, we will highlight the important role of money wage stickiness and real wage resistance respectively in the process of international adjustment following an exchange rate change. We consider our model a minimal monetary two country framework, rich enough to demonstrate that an exchange rate change under nominal wage rigidity in both countries has simultaneously a demand and supply side effect. While the demand side effect of a devaluation of the domestic currency is known from the orthodox monetary approach as a windfall wealth effect accruing to holders of cash balances denominated in foreign currency units, we will emphasize here a further supply side effect of a domestic devaluation, stemming from the need of foreign producers to stay competitive in a world where the same good is produced in each economy under different national cost conditions.[5] Assuming for the sake of argument that prices of domestic goods are fixed at a level just covering domestic unit costs, a domestic devaluation lowers the prices of domestic goods in foreign currency units and, facing domestic goods which now hold a competitive edge over goods of foreign origin

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[4]Most recently a more ambitious attempt to synthesize monetary and Keynesian approaches is made by Frenkel and Gylfason and Helliwell (1979). They model a small open economy with two goods but with complete specialization. They also have two assets and capital mobility.

[5]Note that the competitive adjustment we refer to cannot be found in the more traditional two country model with unemployment, two goods and with complete specialization because producers by assumption do not compete against each other.

(i.e., produced under foreign cost conditions), competition becomes stiffer for foreign producers. Assuming the law of one price in a homogeneous world market, foreign producers feel obliged to reduce the foreign currency sales prices of their own produced goods. This price cut must be directly related to the exchange rate change as long as the domestic currency price of goods of domestic origin is expected to stay constant. On the other hand, for a domestic revaluation foreign producers gain a competitive edge which, under the assumption of a fixed domestic currency price, they may decide to monetize by raising sales prices of foreign produced goods, thereby pocketing an exchange rate change related windfall profit. The important thing to note here is that these price adjustments, enforced by the law of one price and competitive behaviour, give us a direct influence of an exchange rate change on production levels in a world of rigid nominal wages.[6] It turns out, however, that nominal wage rigidity has not been a realistic assumption about the working of the labor market, at least in some European countries during the 70s. Arguing from the viewpoint of such a representative European country dubbed the "domestic" country, we expect the price hike for domestic produced goods made possible due to a domestic devaluation to lead to rising nominal wage claims in an effort by domestic trade unions to protect their real wage. This possibly nullifies any employer's incentive to raise output and employment which they otherwise would have done under the short run marginal cost pricing rule. On the other hand, it is also obvious that negative output and employment effects, resulting from output price cuts which producers must execute after a currency appreciation in an

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[6]Looking at the domestic country in a reverse way this effect is present under nominal wage rigidity in each productive sector of the economy exposed to foreign competition or a world market price denominated in foreign currency units. Hence in a two sector economy it is possible to demonstrate a powerful influence of exchange rate changes upon the productive structure of the economy. This has been shown by Schmid, H. (1979) and has also been a theme in Sachs (1979b).

attempt to stay competitive, could be avoided or mitigated by a policy of wage restraint or a blunt reduction in nominal wages in the case of zero productivity growth.

While all these arguments are well known from the German economic policy debate, the present paper develops a basic model with one eye fixed on the characteristic features of these arguments and the other looking for a minimal algebraic framework. We also like to relate this article to work done by Corden (1978) for a closed economy. In his paper Corden discusses the inter-relationship between real and money wage levels and aggregate demand management in determining employment in a closed economy. We will make use of Corden's taxonomic framework throughout this paper. Asking Corden's basic questions in an international setting, Branson and Rotemberg (1979) in a recent paper contribute to the dispute on the feasibility of demand management policies in internationally linked economies under fixed exchange rates. The present paper can be considered as carrying on the analysis of Branson and Rotemberg to a two country framework with varying exchange rates.[7] We proceed now along a line of arguments the reader may follow from the Survey of Content.

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[7]The model presented in Section 2 has been developed in Chapter 4 of the author's Habilitationsschrift Schmid (1978). Apart from some minor points concerning the technical representation, the same model was independently used by Branson-Rotemberg (1979) in their study of demand management policies under fixed exchange rates.

SURVEY OF CONTENT

2. The Model

Building Blocs[8]

We begin with a specification of the supply side. Both countries produce different amounts y, y* of the same unique good which exists in our world economy. Applying country specific ordinary neoclassical linear homogeneous technologies to given supplies of factor resources in each country we can describe national physical production.

$$(1) \qquad y = F(\ell;\bar{K}) \qquad y^* = F^*(\ell^*;\bar{K}^*)$$

We explain short-run supply for given national capital stocks in each country assuming a marginal cost-pricing rule in the productive sector. This permits a simple statement of price-output response.[9] Let P,P* be price levels for the same unique good in national currency units, W, W* the nominal wage rates, and R,R* the rental rates, each in national currency units. Then with a linear homogeneous technology, national price covers national unit-factor costs.

$$(2) \qquad P = a_\ell W + a_k R \qquad a_\ell \equiv \ell/y; \qquad a_k \equiv K/y$$

Under a linear homogeneous technology, unit labor and unit capital requirements $a_i (i = \ell,k)$ are known to be functions only of the relative factor price ratio (W/R). Making use of the condition for cost minimization we can differentiate (2) to get

$$(3) \qquad \hat{P} = \theta_\ell \hat{W} + \theta_k \hat{R}$$

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[8] In the exposition of the model we freely draw upon the author's forthcoming article Schmid (1980).

[9] To save space we explain price-output response only for the domestic country.

In (3) we find factor shares $\theta_\ell \equiv (W/P)a_\ell$; $\theta_k \equiv (R/P)a_k$ which sum to unity. The same shares appear if we differentiate (1).

$$\hat{y} = \theta_\ell \hat{\ell} + \theta_k \hat{K}$$

Defining factor intensity as $\varkappa = K/\ell$, we can determine output changes by changes in factor intensity and the level of factor use.

$$\hat{y} = -\theta_\ell \hat{\varkappa} + \hat{K}$$

It is well known that the definition of the elasticity of factor substitution relates relative changes in factor intensity and the factor price ratio in the following way.

$$\hat{\varkappa} = \hat{a}_k - \hat{a}_\ell = -\sigma(\hat{R} - \hat{W}) \qquad \sigma > 0$$

Now output response can be shown to be a function of changes in the factor price ratio given the capital stock as well as a function of total factor use given the relative factor price W/R.

(4) $$\hat{y} = \theta_\ell \sigma(\hat{R} - \hat{W}) + \hat{K}$$

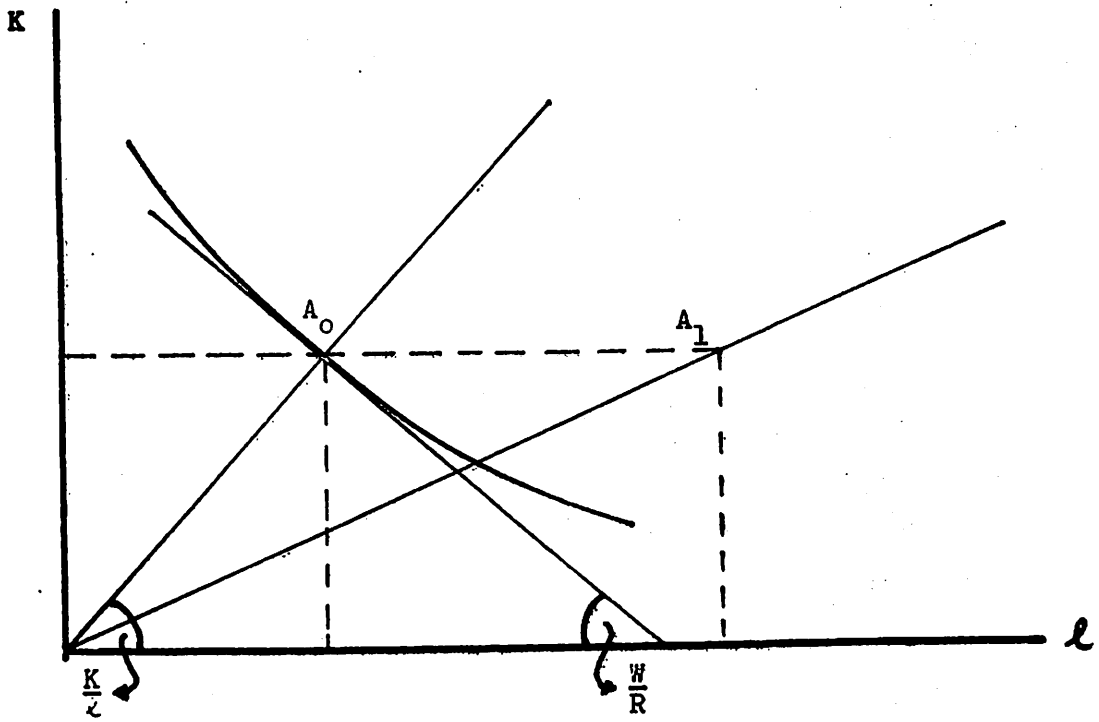
Equations (3) and (4) catch price output response of the productive sector in a sufficient general manner. Using (3) to replace $\hat{R}$ in (4) brings out a short-run supply elasticity.

(5) $$\hat{y}/\hat{P}\Big|_{\hat{W}=0} = \frac{\theta_\ell}{\theta_k}\sigma > 0 \qquad \text{with } \hat{K} = 0$$

Note that the short-run supply function

(6) $$y = y(P; \bar{W}, \bar{K})$$

is conditional upon the fixed capital stock and the level of nominal wages. Note further that, if we move along the given ss supply curve in Figure 1, the rental rate of the fixed capital stock must change. On the other hand, if we



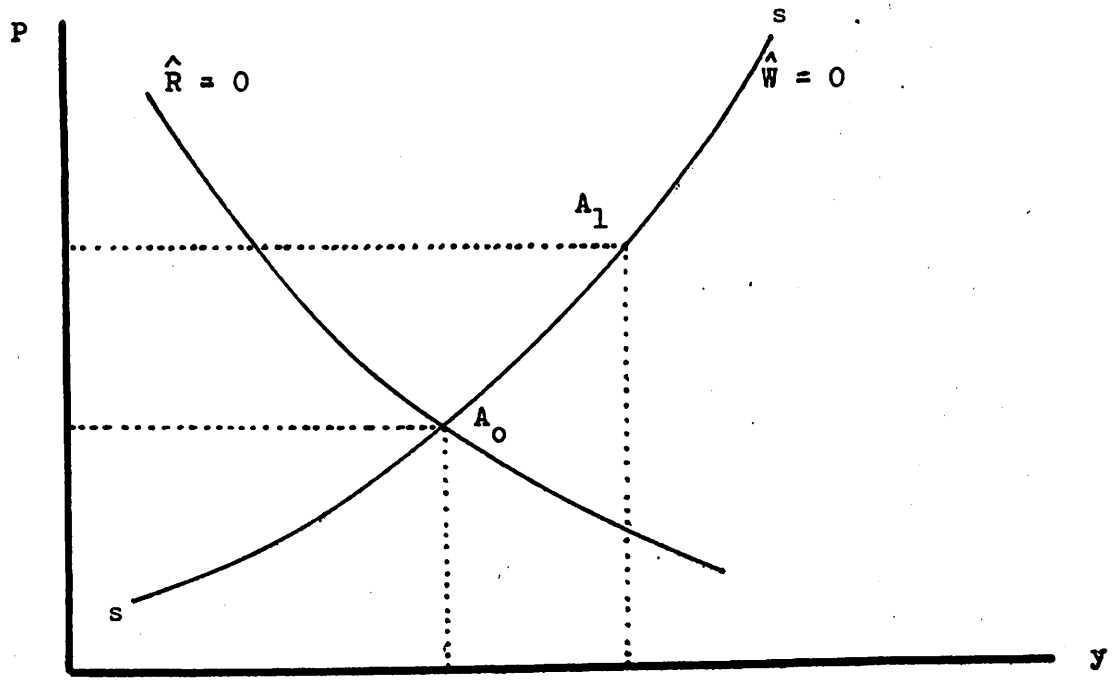


fig. 1

hold constant the rental rate we can determine from (3) and (4) the price-output response of a change in the nominal wage rate, shown as a negatively sloped line in Figure 1. The elasticity of that line is

$$(7) \qquad \hat{y}/\hat{P}\,\Big|_{\hat{R}=0} = -\sigma < 0$$

Since we will focus on relations between price level, output, and nominal wages we substitute for $\hat{R}$ using (3) in (4) to get a useful 'hat'-form of the supply function.

$$(8) \qquad \hat{y} = (\theta_\ell/\theta_k)\sigma(\hat{P} - \hat{W}) \qquad\qquad \hat{K} = 0$$

Equation (8) should not be read as simply saying $\hat{P}$ causes $\hat{y}$. Rather it can be considered as a price setting equation under a marginal cost-price rule. This becomes apparent when we note from (3) that $\hat{P}$ is not an independent variable in (8) if we have an isolated change in W. Note further the zero-homogeneity in W and P of the aggregate supply function (6). That means if price level and nominal wage rate have changed by the same percentage, output remains constant because the rental rate implicitly has changed by the same percentage.

It is clear now that our derivation of the short-run supply curve (6) assumes nominal wage rigidity above the labor market clearing level. Employment then is determined by the short side of the labor market, i.e., the productive sector's labor demand function. While we assume that labor is "rationed" in both countries, we will see later that we assume market clearing for the output market via a rapid price adjustment in the world market for output.

Our discussion of the supply side can be summarized by a useful definition of the elasticity of output with respect to real product wage.

$$\frac{dy}{d(W/P)}\,\frac{(W/P)}{y} = -\epsilon < 0 \qquad \text{with } \epsilon \equiv (\theta_\ell/\theta_k)\sigma$$

Using this definition in (8) we find a simple formulation for the productive

sector's price-output response

(9) $\hat{y} = \epsilon(\hat{P} - \hat{W})$

Similarly we can derive a supply function for the foreign country.

(10) $\hat{y}^* = \epsilon^*(\hat{P}^* - \hat{W}^*)$

Next we turn to a description of the consumption sector by imposing a budget constraint on the representative consumer.

(11) $Y = C + H \qquad \text{with } H \gtrless 0$

Note that the consumption sector spends its nominal income, $Y = Py$, on the purchase of goods, $C = Pc$ (c = physical consumer demand), and accumulation of cash balances, H. However, according to (11), spending for consumption goods may exceed nominal income, a situation where cash balances are diminishing. Routinely, many authors of the monetary approach[10] suppress the spending decision and concentrate on a specification of money demand and supply functions. To bring out the connections between (stock) demand for money and spending we formulate a hoarding function, following Dornbusch (1973).[11] Hoarding is explained as a linear stock adjustment process where actual cash balances, M, are adjusted continually to desired money holdings, L, which in turn are assumed to be a linear function of nominal income ($\dot{L} = (1/\nu)Y$; $1/\nu$ = the inverse of the velocity ν).

(12) $\dot{M} = H = \lambda[(1/\nu)Y - M] \qquad \lambda, 1/\nu = \text{const.} > 0$

The connection between money and spending becomes clear as soon as we enter the

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[10] Among others see Frenkel and Johnson (1976), Laidler (1975), Chs. 7 and 9.

[11] This approach has been criticized on the basis of being 'ad hocish'. The reader is referred to Dornbusch-Mussa (1975) and Helpman (1979) for an intertemporal justification of the hoarding function.

hoarding function (12) in the consumer's budget constraint (11).

$$C = [1 - \lambda(1/\nu)]Y + \lambda M \tag{13}$$

Equation (13) is considered to be a spending function or in a model so simple as the present one we can name it an absorption function. First note the importance of long-run stock equilibrium for the expenditure function (13). If $(1/\nu)Y = M$, stock equilibrium prevails and consumers spend all their income. If $(1/\nu)Y \neq M$, consumers spend more or less than their income, using hoarding or dishoarding to reduce disequilibrium in the stocks of money holdings. Secondly, note the property of linear homogeneity of the expenditure function in Y and M. To explore this property a bit further, let us define the following expenditure elasticities with respect to nominal income and actual cash balances evaluated at a point of long-run stock equilibrium.

$$\frac{\partial C}{\partial Y}\frac{Y}{C} \equiv \alpha = (1 - \lambda(1/\nu)); \quad \frac{\partial C}{\partial M}\frac{M}{C} \equiv \rho = \lambda(1/\nu) \tag{14}$$

We can employ this new notation in differentiating (13) at a point of long-run stock equilibrium to get

$$\hat{C} = \alpha \hat{Y} + \rho \hat{M} \tag{15}$$

In (15) linear homogeneity imposes the following useful condition upon our spending parameters

$$\alpha + \rho = 1$$

Knowing what happens to nominal expenditures sometimes is not enough if we have to deal with an economy where prices and quantities are independent variables. We therefore deflate (13) by the domestic price level to get

$$c = [1 - \lambda(1/\nu)]y + \lambda m \tag{16}$$
$$y = Y/P,\ c = C/P,\ m = M/P$$

The differentiated form of (16) is now

(17) $\hat{c} = \alpha\hat{y} + \rho\hat{m}$

The real expenditure function (17) indicates differences in real consumption behavior not obvious from the nominal expenditure function (15):

(i) A uniform increase of price level and nominal cash balances, holding real income constant, raises nominal expenditure by the same percentage rate while real consumption demand remains constant.[12]

(ii) A uniform increase of real income and nominal cash balances, holding price level constant, raises nominal expenditures by the same percentage rate. This time, however, real consumption demand has increased.

Expenditure behavior of the foreign country is captured by the foreign expenditure function.

(18) $C^* = [1 - \lambda^*(1/v^*)]\, Y^* + \lambda^* M^*$

with $C^* = P^* c^*$, $Y^* = P^* y^*$

Deflating by the foreign price level and differentiating (18) yields

(19) $\hat{c}^* = \alpha^* \hat{y}^* + \rho^* [\hat{M}^* - \hat{P}^*]$

$0 < \alpha^* < 1$ and $\alpha^* + \rho^* = 1$

We complete the exposition of the model by specifying goods market clearing at a uniform world market price.[13] For a goods market equilibrium

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[12] It is clear from (17) that physical domestic demand is not zero homogeneous in the price level and nominal income. Rather this would lower real absorption displaying the parameter ρ as the well known real balance effect.

[13] This is an important assumption because in terms of modern general equilibrium theory under rationing, we assume in our model that national labor markets do not clear while the world goods market clears instantaneously with a flexible output price. Therefore notional output supply is equated to effective demand. See Dixit (1978) for an international trade model with rationing.

national excess demands must be cleared in the world market.

(20) $(c - y) + (c^* - y^*) = 0$

It is in line with the literature, convenient and natural to assume furthermore that the "law of one price" holds in the world market for a homogeneous good. That gives us

(21) $P = EP^*$

In (21) E denotes the price of a foreign currency unit in terms of domestic currency units. Using (20) and (21) allows us to explain the fundamental equivalence between the trade balance and hoarding and present an alternate equivalent specification of goods market equilibrium.

Note first that in a one good world trade in physical terms always is a 'one way street'. A country is exclusively either an exporter or an importer of the final good. Assuming the first possibility, we define the domestic trade balance, B.

(22) $B = -P(c - y) > 0$

Our one good specification helps in understanding the following: A country exhibiting a negative excess demand in physical terms has an excess of income over absorption (underspending).

$$P(c - y) < 0 \Rightarrow Y - C > 0$$

Vice versa we have overspending in the case where absorption exceeds income.

$$P(c - y) > 0 \Rightarrow Y - C < 0$$

According to the budget constraint (11) over or underspending is equivalent to dishoarding or hoarding respectively. Therefore we can state

(23) $B = H$

The simple message the monetary approach has taken over from the absorption approach therefore is: A country having a trade deficit lives beyond its means because it overspends, and can only do so in the short run by running down its cash balances. Therefore trade in a one good world actually is trade between goods and money (as a store of value).

Next multiply (20) by the domestic price level P to get

(24) $(C - Y) + E(C^* - Y^*) = 0$

Using the budget constraint (11) in (24) we find an alternate form of the short-run equilibrium condition.

(25) $H + EH^* = 0$

Equation (25) shows clearly that goods market equilibrium is possible with or without trade balance equilibrium. As long as we have an unbalanced trade account we have an inflow or outflow of money which is used to adjust actual to desired money balances. Only a balanced trade account halts the process of redistribution of money between trading countries and we refer to such a state as a long-run (stock and flow) equilibrium.

The Model and its Geometry

This section presents a condensed algebraic version of the model and develops a geometric exposition. After a few substitutions our model basically consists of two equations in two variables.

(26) $[c(y, M/P) - y] + [c^*(y^*, EM^*/P) - y^*] = 0$

(27) $B = -P[c(y, M/P) - y]$

with $y = y(P; W, \bar{K})$ and $y^* = y^*(P/E; W^*, \bar{K}^*)$

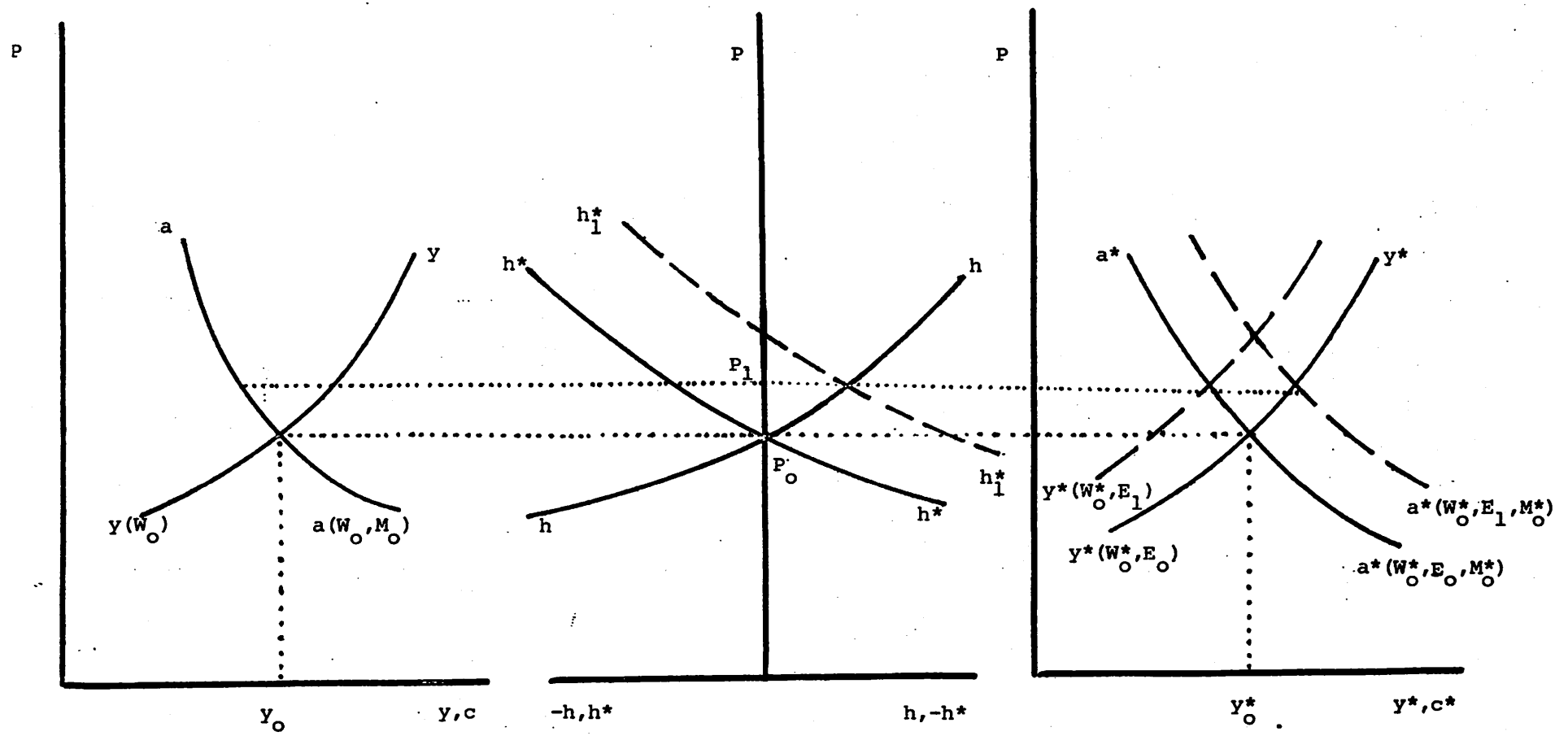
P
a
y
$y(W_o)$
$a(W_o,M_o)$
y_o
y,c
P
h_1^*
h*
h
P_1
P_o
h_1^*
h
h*
-h,h*
h,-h*
P
a*
y*
$y^*(W_o^*,E_1)$
$y^*(W_o^*,E_o)$
$a^*(W_o^*,E_1,M_o^*)$
$a^*(W_o^*,E_o,M_o^*)$
y_o^*
y*,c*

fig. 2

Equation (26) is the goods market equilibrium and (27) specifies the trade balance. Using the information contained in the behavioral functions we can solve the system for $\hat{P}$ and dB, given changes in the exchange rate, $\hat{E}$, nominal wages, $\hat{W}$, $\hat{W}^*$, and the national money supplies, $\hat{M}$, $\hat{M}^*$. We assume that initially the system is in a long-run equilibrium. Then differentiation of (26) and (27) with respect to (17), (19) and (8), (10), (21) yields the following system.

$$(28) \qquad \begin{bmatrix} \xi\rho(1+\epsilon) + \xi^*\rho^*(1+\epsilon^*) & 0 \\ \xi\rho(1+\epsilon) & -(1/\bar{Y}) \end{bmatrix} \begin{bmatrix} \hat{P} \\ dB \end{bmatrix}$$

$$= \begin{bmatrix} \xi\rho & \xi^*\rho^* & \xi^*\rho^*(1+\epsilon^*) \\ \xi\rho & 0 & 0 \end{bmatrix} \begin{bmatrix} \hat{M} \\ \hat{M}^* \\ \hat{E} \end{bmatrix} + \begin{bmatrix} \xi\rho\,\epsilon & \xi^*\rho^*\epsilon^* \\ \xi\rho\,\epsilon & 0 \end{bmatrix} \begin{bmatrix} \hat{W} \\ \hat{W}^* \end{bmatrix}$$

$$|D| = -(1/\bar{Y})\Delta < 0$$

$$\Delta = \xi\rho(1+\epsilon) + \xi^*\rho^*(1+\epsilon^*) > 0$$

$$\xi = y/\bar{y}; \quad \xi^* = y^*/\bar{y} \qquad \text{with } \bar{y} = y + y^*$$

$$\bar{Y} = Py + EP^*y^* = P\bar{y}$$

To ease understanding of the adjustment process in our world economy (28) we next discuss a geometric exposition of the model. In Figure 2 the left-hand diagram shows domestic short-run aggregate supply as an upward sloping yy curve. It should be recalled that this curve has domestic nominal wage level, W_o, as a parameter. Further we define a downward sloping aa curve for real domestic absorption as a negative function of the domestic price level. The aa curve depicts the following function for domestic real absorption.

(29) $\quad c = c(y(P, W_o), M_o/P)$

Note that domestic nominal wage and money supply are parameters of the aa curve. More important we find from (29) the following ambiguity with respect to the price elasticity of absorption.

(30) $\quad \hat{c}/\hat{P}\Big|_{aa} = [\alpha\,\epsilon - \rho] \gtrless 0$

Given the price-output response elasticity, ϵ, a price level increase tends to increase absorption via increased real income and discourage absorption via a negative real balance effect. According to (30) the larger is ρ the more negative the net effect of a price level increase may become.[14] However, for small values of ρ, the real income effect dominates the real balance effect and real absorption increases with a rising price level. The right-hand diagram in Figure 2 similarly portrays curves for the foreign country. Besides foreign money supply and wage level, the exchange rate is also a parameter of <u>both</u> curves. The a*a* curve depicts the foreign (real) absorption function.

(31) $\quad c^* = c^*(y^*(P/E, W^*), (E/P)M^*)$

Differentiating (31) we find

(32) $\quad \hat{c}^*/\hat{P}\Big|_{a^*a^*} = [\alpha^*\epsilon^* - \rho^*] \gtrless 0$

(33) $\quad \hat{c}^*/\hat{E}\Big|_{a^*a^*} = \hat{c}^*/\hat{P}\Big|_{a^*a^*}$

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[14] Note that $\epsilon = 0$ suppresses the real income effect and emphasizes the real balance effect which figures prominently in most early expositions of the monetary approach. If $\rho = 0$ the aa and yy curves coincide.

Equation (32) is analogous to what we had for the domestic economy. More interesting, however, is (33) because it shows that, on direct impact (i.e., holding constant the domestic price level), a devaluation of the domestic currency has an ambiguous effect on foreign real absorption. This property is related also to the slope of the foreign a*a* curve. An important tenet of the monetary approach always has been the "windfall gain" which holders of foreign currency enjoy in terms of purchasing power when the domestic currency is devalued. Obviously, however, if they hold real output constant, orthodox monetary approaches neglect a negative real income effect in the foreign country, which is present as soon as we take into account the idea of competitiveness in a world market where producers sell goods manufactured under cost conditions dominated by fixed national wage levels. As hinted in our introduction, a devaluation of the domestic currency lowers foreign currency sales prices of domestic goods. In an effort to stay competitive, foreign producers must lower the price of their goods exactly by a margin given by the exchange rate change. Downward wage stickiness in the foreign country prevents any possible adjustment in a neoclassical productive sector other than a reduction in foreign output and employment together with a falling rental rate for the fixed foreign capital stock.[15] The resulting real income loss in the foreign country cuts down foreign real absorption and condition (32) rules whether the net effect of a devaluation of the domestic currency upon foreign real absorption is positive or negative. The devaluation induced competitive price losses of the foreign productive sector show up as a leftward shift of the foreign supply curve y*y*. According to (33) a devaluation of

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[15]This statement presumes zero productivity growth.

of the domestic currency shifts the a*a* curve to the right if and only if that line is downward sloping, i.e., if ρ^* is relatively large given ϵ^*.

The middle diagram in Figure 2 shows real domestic (foreign) hoarding on the positive (negative) abscissa. The domestic (foreign) real hoarding function is portrayed in Figure 2 as the positively (negatively) sloped hh (h*h*) curve. Given our assumptions the positiveness (negativeness) of the slope of these two lines does not depend upon the positive or negative slopes of the underlying aa and a*a* curves.[16] A long-run equilibrium of the model is shown by the intersection point, P_o, of the hh and h*h* line on the ordinate. Intersections to the right of the ordinate depict domestic trade deficits.

3. Devaluation Under Rigid Nominal Wages

The results for a devaluation of the domestic currency with nominal wage rigidity in both countries follow from (28).

$$\hat{P}/\hat{E} = \frac{\xi^*\rho^*(1+\epsilon^*)}{\Delta} > 0 \qquad \hat{P}^*/\hat{E} = -\frac{\xi\rho(1+\epsilon)}{\Delta} < 0$$

(34)
$$\hat{y}/\hat{E} = \frac{\epsilon\,\xi^*\rho^*(1+\epsilon^*)}{\Delta} > 0 \qquad \hat{y}^*/\hat{E} = -\frac{\epsilon^*\,\xi\rho\,(1+\epsilon)}{\Delta} < 0$$

$$dB = \xi\,\xi^*\,\bar{Y}\,\frac{\rho(1+\epsilon)\rho^*(1+\epsilon^*)}{\Delta} > 0 \qquad \hat{\bar{y}} = \xi\,\xi^*\,\frac{\epsilon\rho^*(1+\epsilon^*) - \epsilon^*\rho(1+\epsilon)}{\Delta} \gtrless 0$$

$$\Delta = \xi\rho(1+\epsilon) + \xi^*\rho^*(1+\epsilon^*)$$

Devaluation affects output, prices, and employment in both countries in a way known as the 'beggar my neighbor' policy. The trade balance of the devaluing country improves and world output may increase or decrease.

We can discuss devaluation in more detail using the geometric apparatus in Figure 2. The adjustment process is dominated by two basic effects: (i) a

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[16] This follows from $\hat{c}/\hat{P}\Big|_{yy} - \hat{c}/\hat{P}\Big|_{aa} = \rho(1+\epsilon) > 0$

windfall gain of increased purchasing power accruing to holders of foreign cash balances, and (ii) a competitive downward adjustment in sales prices of foreign produced goods. With nominal wages rigid in the foreign country, the latter effect causes a slump in foreign output and employment which is visualized in Figure 2 as a shift of the y*y* line to the left. On the consumption side the drop in real income may or may not be large enough to match the consumer's willingness to increase absorption due to their devaluation-related wealth increase. The special case where the wealth effect dominates the real income effect is shown in Figure 2, where the a*a* curve shifts to the right as a consequence of the devaluation. Obviously a devaluation of the domestic currency has created excess demand for goods in the foreign country at the ruling domestic currency price for goods, P_o.[17] However, in an open economy the foreign excess demand[18] spills over to the world market raising the world market price denominated in domestic currency units. The price level increase induces the domestic economy to satisfy the foreign claims for more goods on two counts. First, domestic production is enlarged, and second, domestic absorption is crowded out if the negative real balance effect of the rising price level dominates the positive real income effect[19]

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[17]Note that initially the foreign price level was adjusted downwards by the devaluation percentage rate.

[18]The reader should convince himself that appearance of excess demand is not dependent upon the slope of the a*a* curve.

[19]Crowding out is the adjustment process propagated by authors of the orthodox monetary approach. Our model does not rely solely on the real balance effect. Even with raising real absorption the domestic country will come up with an excess supply of goods.

(as shown in Figure 2). More technically, a devaluation shifts the h*h* line to $h_1^* h_1^*$ thereby increasing the domestic price level from P_o to P_1. Notice that this price level increase weakens somewhat the necessity of competitive price cuts in the foreign economy and subsequent output reductions, which foreign producers had to execute in the beginning. Price formulas in (34) reveal those strategic forces which determine the distribution of the burden of adjustment between a domestic price level increase and a foreign price fall. Excluding the unrealistic borderline cases of $\rho = 0$ or $\xi = 0$,[20] we have

$$0 < \hat{P}/\hat{E}, \quad |\hat{P}^*/\hat{E}| < 1$$

We can derive some general conclusions from observing

$$(35) \qquad \frac{\partial(\hat{P}/\hat{E})}{\partial \epsilon} < 0, \quad \frac{\partial(\hat{P}^*/\hat{E})}{\partial \epsilon} > 0; \quad \frac{\partial(\hat{P}/\hat{E})}{\partial \epsilon^*} > 0, \quad \frac{\partial(\hat{P}^*/\hat{E})}{\partial \epsilon^*} < 0$$

The more elastic is the price-output response of a country's productive sector and the smaller is its marginal propensity to spend, then the greater will be the shift of the burden of price adjustment after a devaluation to the rest of the world.

$$(36) \qquad \frac{\partial(dB/\hat{E})}{\partial \rho} > 0; \quad \frac{\partial(dB/\hat{E})}{\partial \epsilon} > 0; \quad \frac{\partial(dB/\hat{E})}{\partial \rho^*} > 0; \quad \frac{\partial(dB/\hat{E})}{\partial \epsilon^*} > 0$$

The more the international adjustment following a devaluation works via changes in production and real income because of a highly elastic price-output response, the greater is the impact of a devaluation on the trade balance. Similarly, lower propensities to spend in either country increases the devaluation-related deficit between them.

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[20] $\rho = 0$ implies $\alpha = 1$ and price level increases cannot create excess supply in the domestic country because any productive increases are absorbed domestically. $\xi = 0$ is the case of a small country.

4. Aggregate Demand and Supply Analysis

Our exposition so far has been only peripherally concerned with the allocation of short-run effects on output and prices following an exchange rate shock. In this section we will introduce aggregate demand and supply analysis of devaluation. This alternate exposition of our model allows us to better focus on the role of real wage resistance.

The basic idea of all aggregate demand and supply analysis is simply to bring out price level and output as separate variables. Therefore we rewrite (26) as follows

$$(37) \qquad y = c(y, M/P) + [c^*(y^*, EM^*/P) - y^*]$$

$$\text{with} \qquad y^* = y^*(P/E; W^*, \bar{K}^*)$$

(37) is the equation of an aggregate demand curve relating to the domestic economy. Note that (37) is a function in y,P space if we solve out y* using the foreign short-run supply curve. Differentiation of (37) yields

$$(38) \qquad [\xi\rho + \xi^*\rho^*(1 + \epsilon^*)]\hat{P} + \xi\rho\hat{y} = \xi\rho\hat{M} + \xi^*\rho^*\hat{M}^* + \xi^*\rho^*(1 + \epsilon^*)\hat{E} + \xi^*\rho^*\epsilon^*\hat{W}^*$$

The aggregate demand curve is shown in Figure 3 as $y^d y^d$. This line must fall if $0 < \rho < 1$ because at a given price level an increase in y creates excess supply. This can be choked off only by a falling domestic price level, which encourages aggregate demand via a domestic wealth effect and stimulating foreign demand for domestic exports. The aggregate demand curve shifts when one of its parameters M, M*, W*, E is changed. Next we notice in Figure 3 the upward sloping $y^s y^s$ curve. That curve is the image of the domestic country's short-run price output behavior, or, as shown below, its aggregate supply curve.

$$(39) \qquad y = y(P; W, \bar{K})$$

The price elasticity of this curve is $\hat{P}/\hat{y} = 1/\epsilon > 0$, out of reasons we have discussed above. Finally, Figure 3 presents a falling BB line. That line depicts equilibrium of the domestic trade balance.

(40) $\qquad B = P[y - c(y, M/P)]$

The trade balance equilibrium line must be downward sloping because an output increase creates a trade surplus if $0 < \rho < 1$. Therefore a falling price level must stimulate domestic absorption if we wish the domestic trade balance to stay in equilibrium. Closer inspection of (40) reveals that the price elasticity of the BB curve is $\hat{P}/\hat{y} = -1$. This follows from the linear homogeneity property of our absorption function. Comparison of the elasticities of the BB and $y^d y^d$ lines shows a steeper slope for the BB line as long as a fall in the domestic price level successfully attracts foreign demand for domestic goods.

$$\hat{P}/\hat{y}\Big|_{y^d y^d} = -\frac{\xi\rho}{\xi\rho + \xi^*\rho^*(1+\epsilon^*)} > -1 = \hat{P}/\hat{y}\Big|_{BB}$$

A long-run equilibrium of the domestic economy is shown in Figure 3 at point A_o where all three lines have a common intersection point.[21]

To get a more complete picture, particularly of the impact of some strategic exogenous variables, we use the differentiated version of (37), (39), (40). That yields the following system

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[21] It is interesting to note the geometric similarity but analytical differences between our Figure 3 and Figure 18.7 in Dornbusch-Fischer (1978a). They use their diagram to support an informal discussion of what they call the classical adjustment mechanism in a two-good small-country framework. See also Dornbusch and Fischer (1978b).

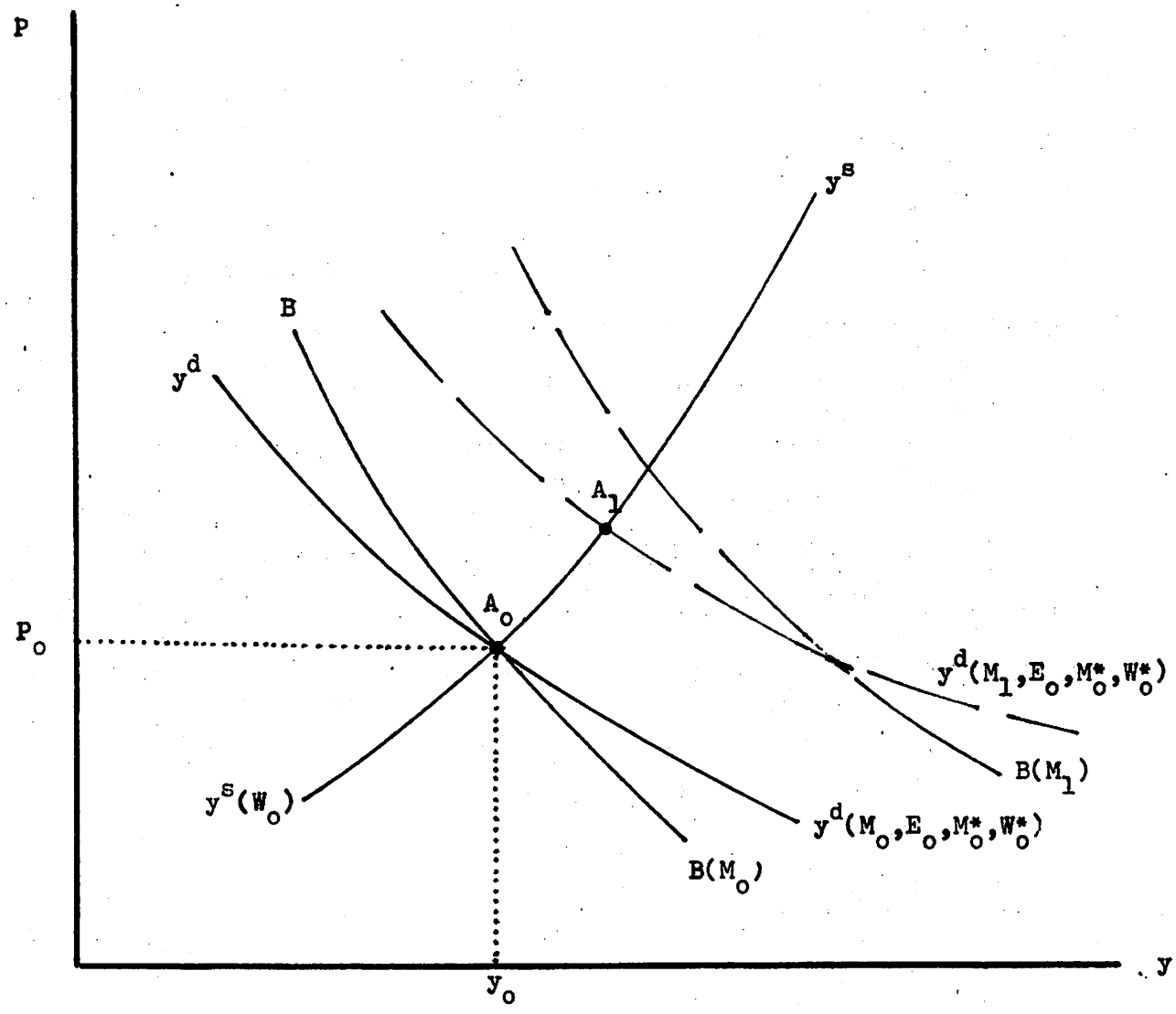

fig. 3

$$(41)\qquad \begin{bmatrix} \epsilon & -1 & 0 \\ \xi\rho + \xi^*\rho^*(1+\epsilon^*) & \xi\rho & 0 \\ \xi\rho & \xi\rho & -(1/\bar{Y}) \end{bmatrix} \begin{bmatrix} \hat{P} \\ \hat{y} \\ dB \end{bmatrix}$$

$$= \begin{bmatrix} 0 & 0 \\ \xi\rho & \xi^*\rho^* \\ \xi\rho & 0 \end{bmatrix} \begin{bmatrix} \hat{M} \\ \hat{M}^* \end{bmatrix} + \begin{bmatrix} \epsilon & 0 & 0 \\ 0 & \xi^*\rho^*\epsilon^* & \xi^*\rho^*(1+\epsilon^*) \\ 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} \hat{W} \\ \hat{W}^* \\ \hat{E} \end{bmatrix}$$

$$|D| = -(1/\bar{Y})\Delta < 0 \qquad \text{with } \Delta = \xi\rho(1+\epsilon) + \xi^*\rho^*(1+\epsilon^*) > 0$$

The importance of (41) derives from its apparent capability to capture algebraically the shifts of each line in Figure 3 due to changes in exogenous variables. It is interesting to note that the variables E, M*, W*, influence the system exclusively via the goods market equilibrium line $y^d y^d$ while W affects only the $y^s y^s$ line.

Money Supply Change

An increase in M shifts both the BB and the $y^d y^d$ line to the right by exactly the same amount. In a one good model holding the price level constant, obviously the same output increase which keeps the goods market in equilibrium after a money supply rise can balance the trade account. In consequence a domestic supply increase with rigid nominal wages increases the price level and employment (see the dashed lines in Figure 3). It also creates a domestic deficit because domestic residents overspend.

Devaluation

Using Figure 4 allows us to visualize the impact of an exchange rate change under nominal wage rigidity in both countries in an alternate manner. We have argued above that a devaluation will create excess demand for final goods in the foreign country on two grounds: (i) competitive price adjustments reduce foreign output and real income and (ii) a real wealth effect enlarges foreign absorption. The resulting foreign excess demand appears as a rightward shift of $y_o^d y_o^d$ towards $y_1^d y_1^d$. The new equilibrium point A_1 shows an increased price level together with reduced unemployment and a surplus of the domestic current account.

Nominal Wage Push

Prior to our discussion of the effects of devaluation under real wage rigidity, it will be worthwhile to briefly examine the impact of a domestic wage push in our model.[22] It is helpful to use Figure 4 to summarize the main results: A domestic wage push shifts our $y_o^s y_o^s$ curve upwards.[23] The new equilibrium point A_2 indicates higher unemployment, a higher price level, and a domestic trade deficit. From (41) it follows that a domestic wage push will increase foreign output.[24] In short, the basic reason for these results

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[22]Elsewhere the present author, Schmid (1980), has analyzed nominal wage shocks in the present framework in much greater detail. Mussa (1979) has a discussion of wage shocks in a two good, two country model.

[23]Note that a given percentage increase in the nominal wage rate determines only one well defined point on the new $y^s y^s$ line. The new aggregate supply line as a whole is created by additional changes in the rental rate, i.e., the factor price of the fixed factor of production.

[24]It can be shown that the domestic rental rate is reduced while the foreign rental rate has increased.

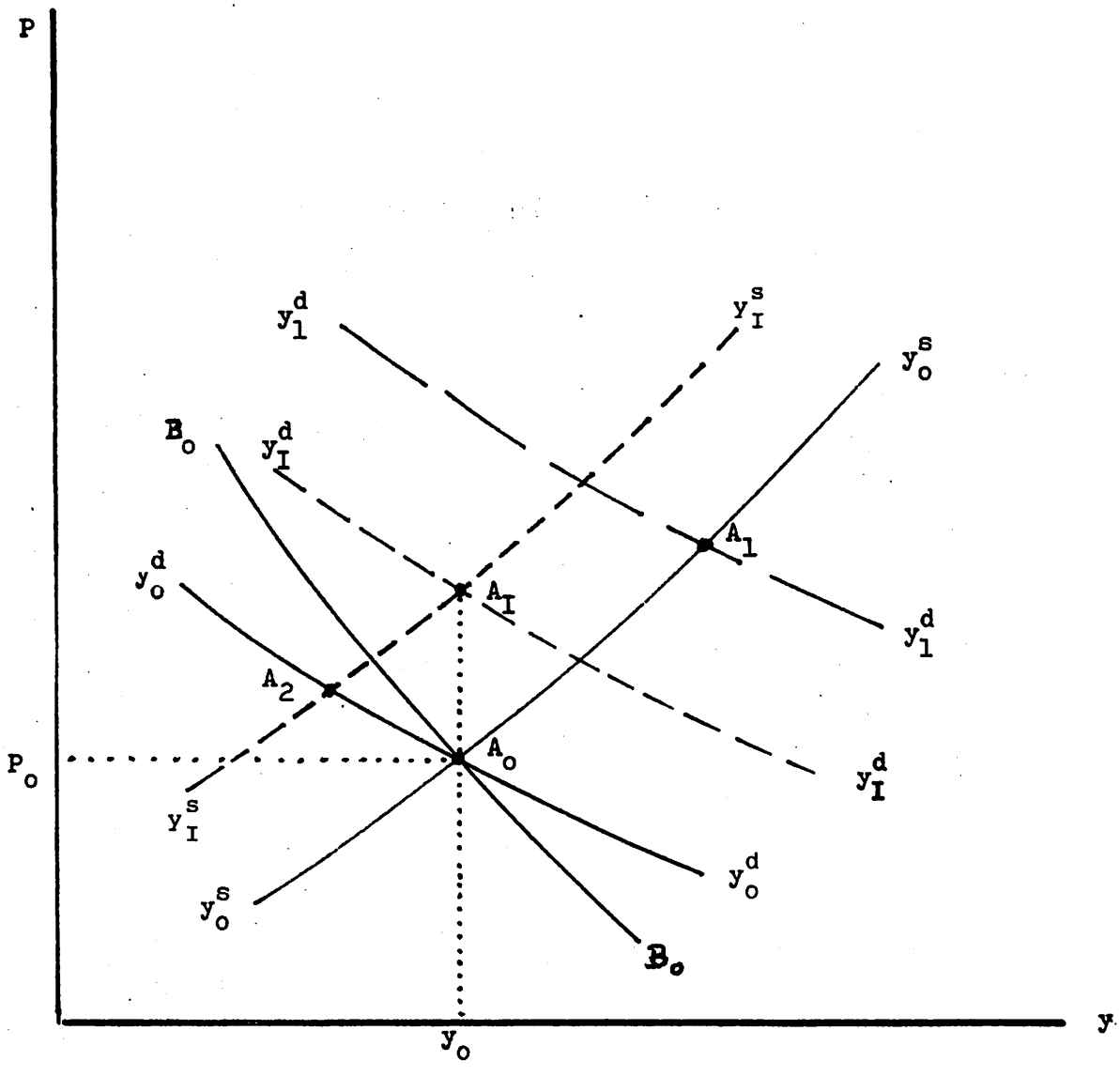

fig. 4

is domestic excess spending after a wage push, because domestic absorption falls less than domestic output at a given domestic price level. The domestic excess demand for goods is met by the foreign country at the higher domestic currency price level. Similarly a policy of domestic wage restraint ($\hat{W} < 0$) can be shown from (41) to be a 'beggar my neighbor' policy under a regime of fixed exchange rates. It exports domestic unemployment to the foreign country because at a given domestic currency price level with $0 < \alpha < 1$, the increase in domestic absorption falls short of the increase in domestic production. The domestic excess supply places downward pressure on world market price and, at falling world market prices, foreign producers cut down their production if foreign nominal wages are sticky while simultaneously foreign consumers spend their excess cash balances. Hence at a lower domestic-currency price level the domestic excess supply can be sold to the foreign country. Comparing the outcomes of a policy of money supply increase and a policy of wage restraint it is important to note that both policies <u>increase</u> domestic real income. However, the supply side policy creates trade surpluses while the demand side policy creates deficits. Hence in our model the nexus between domestic income and the trade balance is more sophisticated than in the traditional income expenditure model.

5. Devaluation with Rigid Real Wages

So far in our analysis of devaluation we have assumed nominal wage rigidity in both countries. Under nominal wage rigidity foreign producers reduced their production levels when they were forced to cut sales prices of their products in an effort to stay competitive after the domestic devaluation. We get a very different adjustment if we instead assume a downward adjustment of foreign nominal wages. If labor unions in the foreign country could be persuaded to act 'price responsive' with their nominal wage claims, i.e., adjust nominal wages in a downward direction, then this policy of foreign wage restraint would hinder domestic producers from having a competitive edge over foreign producers. Foreign producers could sustain the current level of production and employment. This would wipe out the contractionary real income effect. However, it would not eliminate a build up of foreign excess demand because we have left the real balance effect of domestic devaluation upon foreign currency owners. Hence, as before, we will find world market pressure originating from the foreign country which raises the price level for goods measured in domestic currency units. As before, this tends to stimulate domestic production at given domestic wages. Assuming, however, that domestic suppliers of labor resist a decline in domestic real wage and therefore claim higher nominal wages, domestic output will not adjust to the price level change and, in order to match the foreign excess demand the adjustment mechanism must rely solely on a crowding out effect upon domestic absorption. It is a domestic real balance effect which does the job. We next want to give a more formal expression to the described scenario, and later we shall show that the assumption of real wage resistance, i.e., complete

up- and downward mobility of nominal wages irrespective of the unemployment situation creates or the assumption of a classical labor market with constant labor supply in both countries creates exactly the Dornbusch (1973) version of the monetary approach.

The Labor Market

To fix ideas we first take a closer look at the national labor markets which later we shall assume not to work in exactly the same way in both countries.[25] It is possible to endogenize the unemployment rate if we incorporate a labor supply function in our model. Making labor supply a positive and increasing function of the expected real wage rate we postulate

$$(42) \qquad \ell_s = \ell_s(W/P^e)$$

If we define $\omega = u/\ell_s$ with $u = \ell_s - \ell_d$ being the number of unemployed as a percentage of those willing to work at the ruling nominal wage rate W_o, we can explain the change in unemployment

$$(43) \qquad \hat{u} = \frac{1}{\omega}\hat{\ell}_s - \frac{1-\omega}{\omega}\hat{\ell}_d$$

With a fixed capital stock demand for labor is strictly related to output $\hat{y} = \theta_\ell \hat{\ell}_d$. Then from (9) we get the labor demand function, $\hat{\ell}_d = (\epsilon/\theta_\ell)(\hat{P}-\hat{W})$. Defining $\Psi > 0$ as the elasticity of labor supply with respect to the expected real wage, we find from (43)

$$(44) \qquad \omega\hat{u} = \Psi(\hat{W}-\hat{P}^e) + (1-\omega)(\epsilon/\theta_\ell)(\hat{W}-\hat{P})$$

According to (43), at the ruling nominal wage a rise in the expected price as well as a rise in the actual price level lowers unemployment and, obviously,

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[25] Recently writers become increasingly aware that different institutional arrangements which rule national labor markets should be taken into account if the process of international adjustment is modelled. See Branson-Rotemberg (1979).

the same outcome follows from a reduction in the nominal wage rate. Equation (44) should not be regarded as an expectations augmented Phillips curve: however, it tries to catch a similar idea in a comparative static setting.

Two more assumptions for a full description of the working of the labor market are required.

(i) It is assumed that nominal wage increases are tied to the expected price level increase by an indexing scheme expressed in the following way

$$\hat{W} = \phi \hat{P}^e \qquad \hat{P}^e \gtrless 0 \qquad 0 \leq \phi \leq 1 \tag{45}$$

If $\phi = 1$, we speak of a fully symmetric indexation scheme.

(ii) We assume that expectations are rational in the sense that labor unions expect a price level increase which is the outcome of the actual economic adjustment process.

$$\hat{P}^e = \hat{P} \tag{46}$$

Using (45) and (46) in (44) yields

$$\hat{u} = -\lambda_\omega (1-\phi)\hat{P} \tag{47}$$

$$\lambda_\omega \equiv \frac{\theta_\ell \Psi + (1-\omega)\varepsilon}{\omega \theta_\ell} > 0$$

(47) explains that under rational expectations a perfect indexation scheme (ϕ=1) raises wages in accordance with prices without any influence on unemployment, while a rising price level without indexation (ϕ=0) lowers unemployment because demand for labor increases and supply of labor decreases. Solving (44) for $\hat{W}$ we can look at (44) as an equation which determines nominal wage rate changes consistent with given changes in unemployment and expected and actual price levels respectively.

$$(48) \qquad \hat{W} = \frac{\theta_\ell \omega}{\theta_\ell \Psi + (1-\omega)\varepsilon}\,\hat{u} + \frac{\theta_\ell \Psi}{\theta_\ell \Psi + (1-\omega)\varepsilon}\,\hat{P}^e + \frac{(1-\omega)\varepsilon}{\theta_\ell \Psi + (1-\omega)\varepsilon}\,\hat{P}$$

Substituting (48) in the short-run supply function (9) yields

$$(49) \qquad \hat{y} = \frac{\varepsilon}{\theta_\ell \Psi + (1-\omega)\varepsilon}\,[\theta_\ell \Psi \hat{P} - \theta_\ell \Psi \hat{P}^e - \theta_\ell \omega \hat{u}]$$

Again (49) should not be considered as the output related version of an expectations augmented Phillips curve.[26] However, the following information is contained in (49). If (ii) holds and wages are adjusted such that unemployment does not change, then the supply curve (49) is vertical. Note further if price expectations do not affect labor supply and nominal wages are adjusted such that unemployment does not change, then the elasticity of output with respect to price level is smaller than the 'short run' elasticity ε. Finally, if under the same circumstances the labor supply curve is perfect elastic then (49) yields the 'short run' aggregate supply curve (9) with constant nominal wages. Assuming (i) and (ii) we can insert (47) in (49) to find an expression which relates output-price response to the degree of wage indexation.

$$(50) \qquad \hat{y} = \varepsilon(1-\phi)\hat{P} \qquad 0 \le \phi \le 1$$

Similarly we find for the foreign country

$$(51) \qquad \hat{y}^* = \varepsilon^*(1-\phi^*)[\hat{P}-\hat{E}] \qquad 0 \le \phi^* \le 1$$

As we expect with perfect indexation ($\phi=\phi^*=1$) output is price inelastic in

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[26] We hasten to point out that (49) is derived from a comparative static framework. Hence the argument behind (49) does not give a micro foundation of the Phillips curves used in econometric work, e.g., Laidler (1975) or Laidler and O'Shea (1980).

both countries. This is the case of complete real wage resistance. Nominal wage rigidity ($\phi=\phi^*=0$) yields a price-output response the reader can recall from Section 3.

The Algebra of Devaluation with Indexed Wages

We replace our short-run supply functions (9), (10) by (50), (51). This gives us the following modified system.

$$(52)\qquad \begin{bmatrix} \epsilon(1-\phi) & -1 & 0 \\ \xi\rho + \xi^*\rho^*[1+\epsilon^*(1-\phi^*)] & \xi\rho & 0 \\ \xi\rho & \xi\rho & -(1/\bar{Y}) \end{bmatrix} \begin{bmatrix} \hat{P} \\ \hat{y} \\ dB \end{bmatrix}$$

$$\begin{bmatrix} 0 & 0 & 0 \\ \xi\rho & \xi^*\rho^* & \xi^*\rho^*[(1+\epsilon^*(1-\phi^*)] \\ \xi\rho & 0 & 0 \end{bmatrix} \begin{bmatrix} \hat{M} \\ \hat{M}^* \\ \hat{E} \end{bmatrix}$$

$$\Delta_I = \xi\rho[1+\epsilon(1-\phi)] + \xi^*\rho^*[1+\epsilon^*(1-\phi^*)]$$

From (52) we can calculate the exchange rate impact in an indexed world economy.

$$\hat{P}/\hat{E} = \frac{\xi^*\rho^*[1+\epsilon^*(1-\phi^*)]}{\Delta_I} > 0; \quad \hat{P}^*/\hat{E} = -\frac{\xi\rho[1+\epsilon(1-\phi)]}{\Delta_I} > 0$$

$$(53)\qquad \hat{y}/\hat{E} = \frac{\epsilon(1-\phi)\xi^*\rho^*[1+\epsilon^*(1-\phi^*)]}{\Delta_I}; \quad \hat{y}^*/\hat{E} = -\frac{\epsilon^*(1-\phi^*)\xi\rho[1+\epsilon(1-\phi)]}{\Delta_I}$$

$$dB = \xi\xi^*\bar{Y}\,\frac{\rho[1+\epsilon(1-\phi)]\rho^*[1+\epsilon^*(1-\phi^*)]}{\Delta_I} > 0$$

$$\hat{y} = \xi\xi^*\,\frac{\epsilon(1-\phi)\rho^*[1+\epsilon^*(1-\phi^*)] - \epsilon^*(1-\phi^*)\rho[1+\epsilon(1-\phi)]}{\Delta_I}$$

The first point to note from (53) is that with nominal wage rigidity we can reproduce our former results given in (34). With a fully symmetric indexation

scheme in both countries we find from (53) that a devaluation has normal price and trade balance effects but does not affect production and employment respectively. In fact it is shown in more detail in the Appendix that setting $\phi = \phi^* = 1$ in (53) yields exactly the results for a devaluation as obtained by Dornbusch (1973). We can demonstrate Dornbusch's theory of devaluation by means of Figure 4. We have argued above that a devaluation under nominal wage rigidity raises the price level denominated in domestic currency and lowers the foreign currency price. We may now see from system (41) that the concomitant domestic nominal wage adjustment shifts the domestic supply curve $y^s y^s$ upwards towards $y_I^s\ y_I^s$ and reduces the original devaluation induced shift of the $y^d y^d$ curve from $y_1^d y_1^d$ to a $y_I^d y_I^d$ position. This dampening effect of course stems from downward adjustment of foreign nominal wages enforced by the fully symmetric indexation rule. While the new equilibrium point A_I shows clearly that devaluation has not affected domestic output and employment, it is not clear from Figure 4 whether the domestic price level as a result of indexation has increased or decreased.[27]

International Adjustment to a Devaluation - Synopsis of Different Approaches

We will now compare the adjustment of our world economy with and without real wage resistance in a more comprehensive way.

To simplify matters we here consider only the special case where a devaluation does not affect world output because both countries are completely identical ($\varepsilon = \varepsilon^*$, $\rho = \rho^*$, and $\xi = \xi^*$). Note first from (53) that under nominal

[27] Comparison of price formulas (34) to (53) assuming $\phi = \phi^* = 1$ reveals that a symmetric indexation scheme brings no additional price effects if and only if price output responsiveness in both economies is equal, i.e., $\varepsilon = \varepsilon^*$. From (35) we can conclude that indexation tends to strengthen (dampen) the domestic price increase caused by a domestic devaluation if price output responsiveness of the domestic productive sector is greater than the one in the foreign country, i.e., $\varepsilon > \varepsilon^*$. In any case indexation dampens the trade surplus for the domestic country following a domestic devaluation.

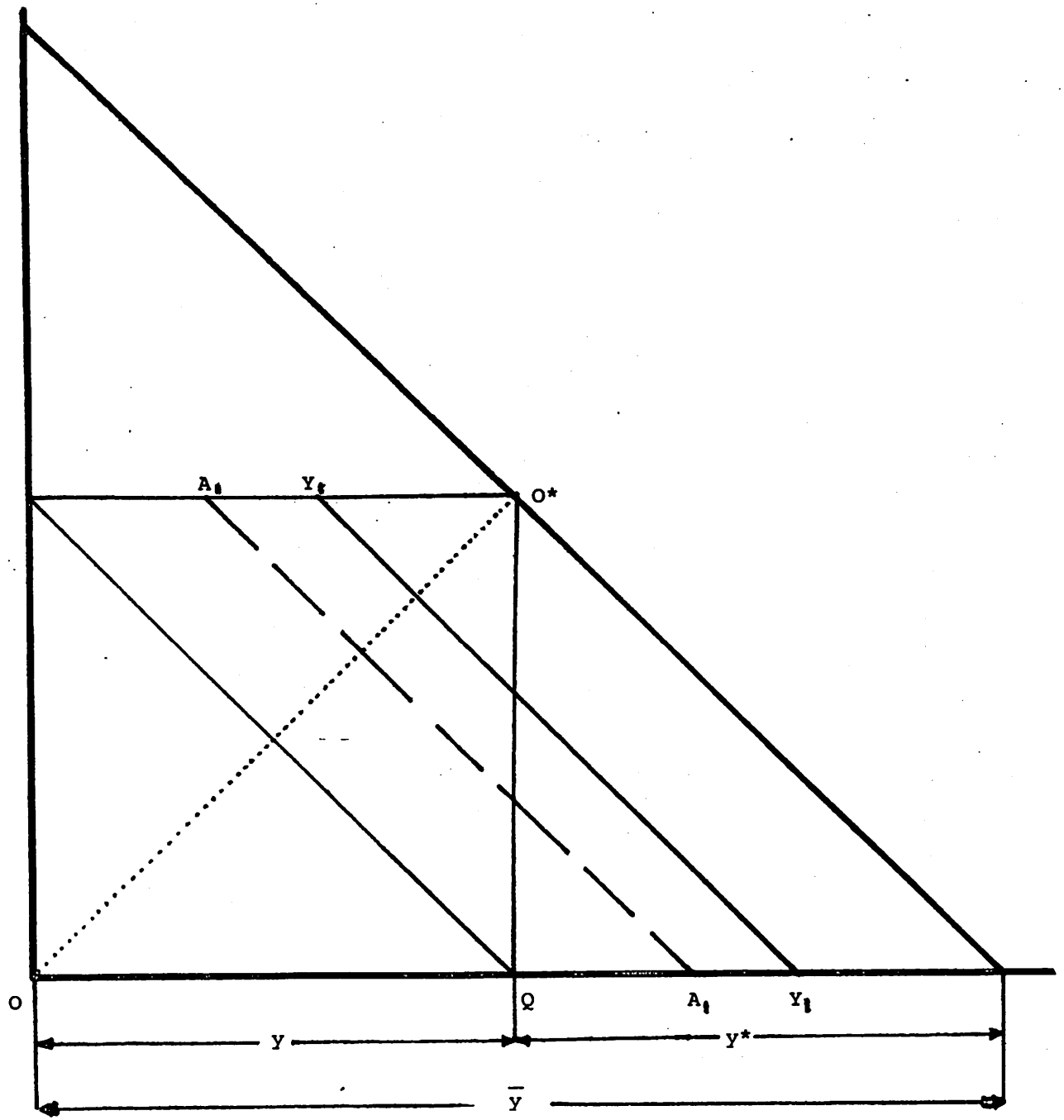

fig. 5

wage rigidity the international division of price adjustment is now symmetric, and that domestic production exactly matches the fall in foreign production. This observation assures us that the 'square' world economy depicted in Figure 5 does not change size, hence the adjustment mechanism is confined to the 'interior' of the world economy. In the initial state point Q in Figure 5 is a point of trade equilibrium where income and absorption lines coincide. The switch in world production towards the domestic country shifts the income line to the right towards Y_1Y_1. Assuming $0 < \alpha = \alpha^* < 1$ domestic absorption grows less than domestic production while foreign absorption declines less than foreign production, leaving the world with a trade deficit. In Figure 5 this must appear as a rightward shift of the absorption line towards A_1A_1 which always falls short of the shift of income line Y_1Y_1. Note that this adjustment mechanism relies on price and income effects and that the distribution of world absorption has been in favor of the country which produces more. This is not necessary, however, if we are prepared to assume that price and (real) income effects offset each other in the absorption functions of both countries ($\alpha\varepsilon = \rho$). This pegs the distribution of world absorption while the distribution of world production is switched towards the devaluing country. Now the absorption line stays put and the domestic trade surplus is equal to the domestic production increase.[28] It is clear now that by assuming $\alpha\varepsilon < \rho$ we can emphasize the real balance effect in both countries. That is, we witness an increase in the domestic trade surplus resulting from

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[28] As the reader may verify from (53) we can obtain the same effect under the weaker assumption of different price-output responsiveness across countries ($\varepsilon \neq \varepsilon^*$) retaining however the assumption of equal size and matching real balance and income effects in both countries ($\alpha\varepsilon = \rho$ and $\alpha^*\varepsilon^* = \rho^*$).

decreased domestic and increased foreign absorption, despite a corresponding increase in domestic production and decrease in foreign production, i.e., the absorption line would shift to the left. The reader will observe that our combination of the income expenditure approach with the quantity theory gives us exactly the full range of adjustment possibilities early writers of so called absorption theory always claimed a devaluation may have. It is also clear now that fixing real income in the adjustment mechanism either on the ground of implicitly assuming a classical labor market (Dornbusch (1973)) or by assuming a fully symmetric wage indexation scheme restricts the international adjustment mechanism to the demand side and we get the familiar "crowding out story" the orthodox monetary approach has popularized. This could be represented in Figure 5 by noting that under real wage resistance in both countries the income line stays put while the absorption line shifts to the left. That gives us again a domestic surplus, however, this time totally at the expense of domestic real absorption.

6. Devaluation as a Policy Tool

In this final section we will first discuss the effectiveness of a devaluation in influencing domestic employment and/or the domestic trade balance, under a variety of circumstances. These will refer to either (i) other domestic policy variables, such as trade union wage behavior, and the domestic monetary authorities' money supply policies, or (ii) to the same set of foreign policy variables. Then applying our model for stabilization of an open economy facing an external disturbance we will compare a strategy of devaluation to the 'classical adjustment mechanism' and to a policy failure which leads to a vicious circle.

Efficacy of a Devaluation

We have seen in Section 5 that a devaluation under perfect symmetric indexation of nominal wages in both countries does not exert any employment effects although it improves the trade balance of the devaluing country. That result seems to depend on trade union behavior in both countries. Therefore we like to prove the following statement: A devaluation in the domestic country has no effect on domestic employment and the trade balance if one of the following sufficient conditions holds:

(a) Domestic nominal wages are indexed (upwards) in an excess supply labor market (or move upwards in a classical labor market under full employment) and this wage policy is accommodated by the domestic monetary authority.

(b) Foreign nominal wages are indexed downwards in spite of foreign unemployment (or are adjusted downwards in a classical labor market) and this policy of wage restraint is accompanied by a restrictive money supply policy of the foreign monetary authority.

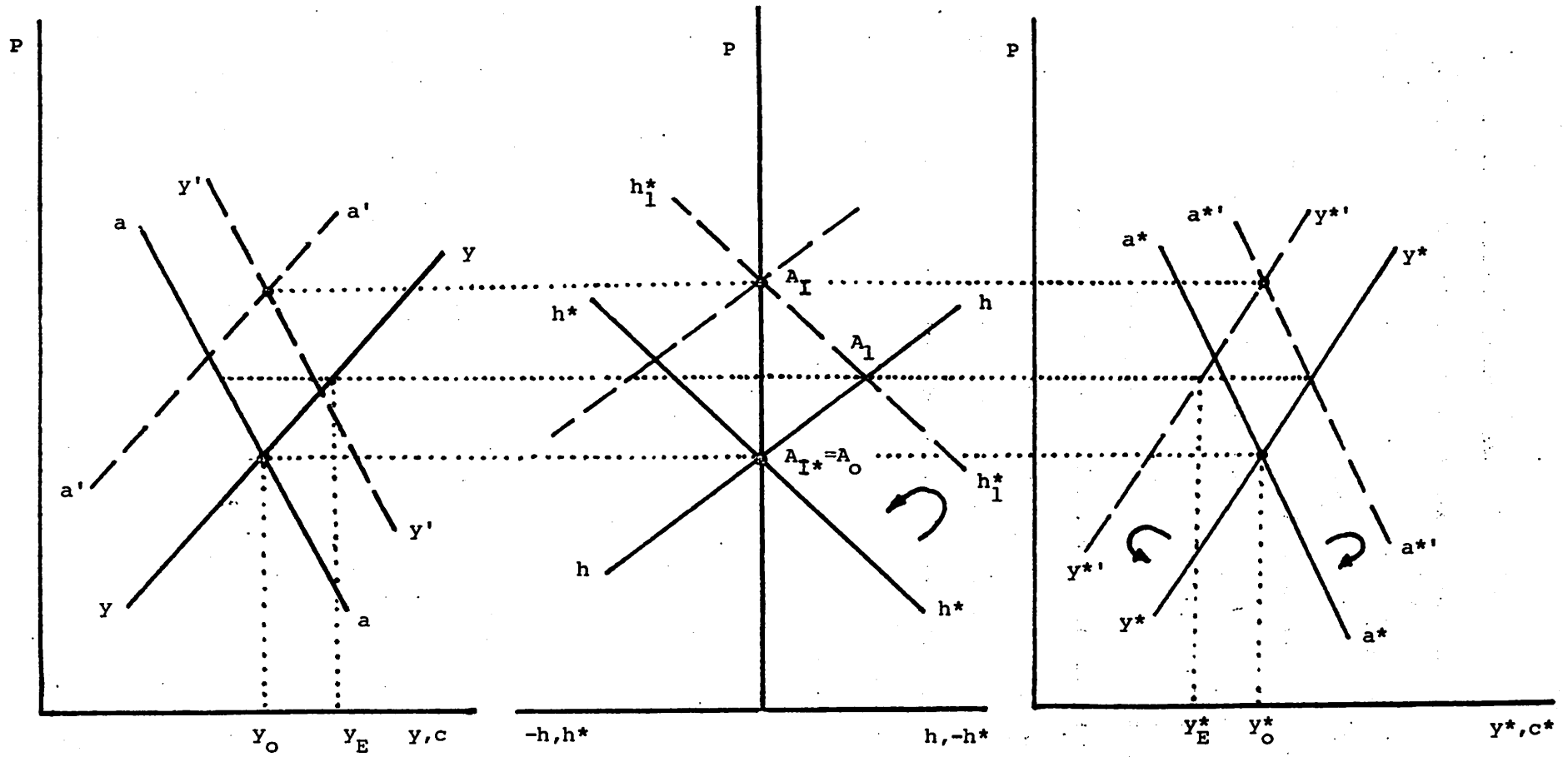
P
y'
a'
a
y
a'
y'
y
a
y_o
y_E
y,c
P
h_1^*
A_I
h
h*
A_1
$A_{I^*}=A_o$
h_1^*
h
h*
-h,h*
h,-h*
P
a*'
y*'
a*
y*
y*'
a*'
y*
a*
y_E^*
y_o^*
y*,c*

fig. 6

The reader can easily obtain a formal proof of our statement by applying in (28) or (41) the condition $\hat{M} = \hat{W} = \hat{E} > 0$ to obtain (a) and $\hat{M}^* = \hat{W}^* = -\hat{E} > 0$ to obtain (b). We use Figure 6 to explain the economics. We know from Section 3 (recall the discussion surrounding Figure 2) that a domestic devaluation under nominal wage rigidity improves domestic employment and the trade balance (see point A_1 in Figure 6 which is produced by a shift of the foreign hoarding line towards $h_1^*h_1^*$). For the sake of argument assume that the foreign currency denominated goods price is held constant at the initial level, just covering foreign unit production costs. A domestic devaluation in this case tends to create a wedge between domestic currency, sales prices of foreign goods and prices of domestic produced goods. If domestic producers, in an effort to pocket windfall profits from that devaluation, close the gap by raising sales prices of domestic goods, we know already that this leads to increased domestic production and employment. If, however, trade unions anticipating under rational expectations the domestic price level increase simultaneously raise the domestic wage rate and hence wipe out the competitive edge, devaluation has no power to reduce domestic real wages and to stimulate domestic employment Rather wages and prices grow at the same percentage rate, which equal to the relative exchange rate change. Assuming further that the monetary authority compensates the negative real balance effect of raising domestic prices by increasing the nominal money supply, we find real domestic absorption unchanged. The left-hand diagram in Figure 6 shows how the devaluation impact has totally dissipated in a domestic price level increase. (Technically speaking the $y^s y^s$ and aa lines have shifted upwards by the relative exchange rate change and consequently the domestic hh line has shifted up until the new equilibrium point A_I is established with the trade balance back in equilibrium.) The above has become a familiar story to explain the neutrality of a devaluation. It is obvious that a devaluation can be made effective on

the basis of this argument as soon as policy makers use policy variables under their own control in a more efficient way. Condition (b) indicates, however, that there is a second possibility to render totally ineffective a devaluation, that being an offsetting policy behavior in the foreign country which, of course, is beyond control of domestic authorities.[29] The argument is as follows: Taking as granted that a domestic devaluation works firstly via a wealth effect upon holders of foreign cash balances and secondly via competitive price concessions on the part of foreign producers, these effects can be counteracted by appropriate foreign policy measures. A policy of monetary restraint exerted by the foreign monetary authority would take away the windfall wealth effect, and a policy of nominal wage restraint on the part of foreign trade unions would restore competitiveness of foreign products without any detrimental effect on foreign employment. Using technical language within the geometrical apparatus we have developed in Figure 6, the foreign country's offsetting behavior can be captured if we say that the foreign y*y* and a*a* curves, initially shifted by the devaluation to their dashed positions, through the foreign policy measures we have described, are forced back to their original positions. Consequently $h_1^*h_1^*$ also shifts back. Note that the foreign country by following this strategy successfully avoided any foreign output recession. The only feature of this foreign concerted action is a fall in the foreign price level by an amount equal to the percentage increase of the exchange rate.

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[29] The following discussion of condition (b) possibly substantiates a warning voiced most recently by Laidler-O'Shea (1980) and similarly by Branson in his comments to Sachs (1979b) against the use of small country models in the interpretation of open economy data. "...these conjectures, then...have important implications for the validity of all those open economy models which are linked to the rest of the world by prices alone. It will mean that they are perhaps adequate for analyzing the response of such an economy to domestic shocks against the background of a tranquil world economy, but that they do not properly capture the channels whereby instability in the world economy is transmitted to an open economy." (Laidler-O'Shea, pp. 27-28.)

Stabilization of an Open Economy

We turn in this final section to consider some implications of our analysis for the problem of stabilization. Assume that the world is on a fixed exchange rate system and that the foreign economy is hit by a contractionary money supply shock. Assume further downward nominal wage rigidity in both countries and upward wage indexation in the domestic economy. The foreign demand shock tends to reduce foreign output and the price level because a situation of excess goods supply has been created by the contractionary money policy. Under fixed exchange rates the foreign "demand side shock" is transmitted to the domestic economy via a fall in world market prices which, under downward rigid domestic nominal wages, creates domestic excess demand. Hence the domestic economy shares the foreign economy's recession thereby cushioning the foreign recession to a considerable degree.[30] In consequence the domestic economy suffers from increased unemployment and a trade deficit (point A_1 in Figure 7).

Next we ask how the domestic economy, ridden by that double misfortune, can be cured. As a first possibility an autonomous exchange rate change could be applied, and it is clear from our analysis that this policy will be successful only if domestic nominal wages are not indexed. In fact this devaluation would automatically be produced under a flexible exchange rate system with nominal wage rigidity. In Figure 7 a devaluation forces the world economy back to its initial point A_0. An alternate solution to the problem is to recognize that the domestic economy must improve its competitive standing and this could be done also by lowering domestic production costs

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[30] Some authors like to say that the foreign country under fixed rates imports stability by exporting its recession. Note that a flexible rate system in our model would provide complete insulation for the domestic economy. It would bottle up the foreign economy and therefore the foreign recession would be aggravated.

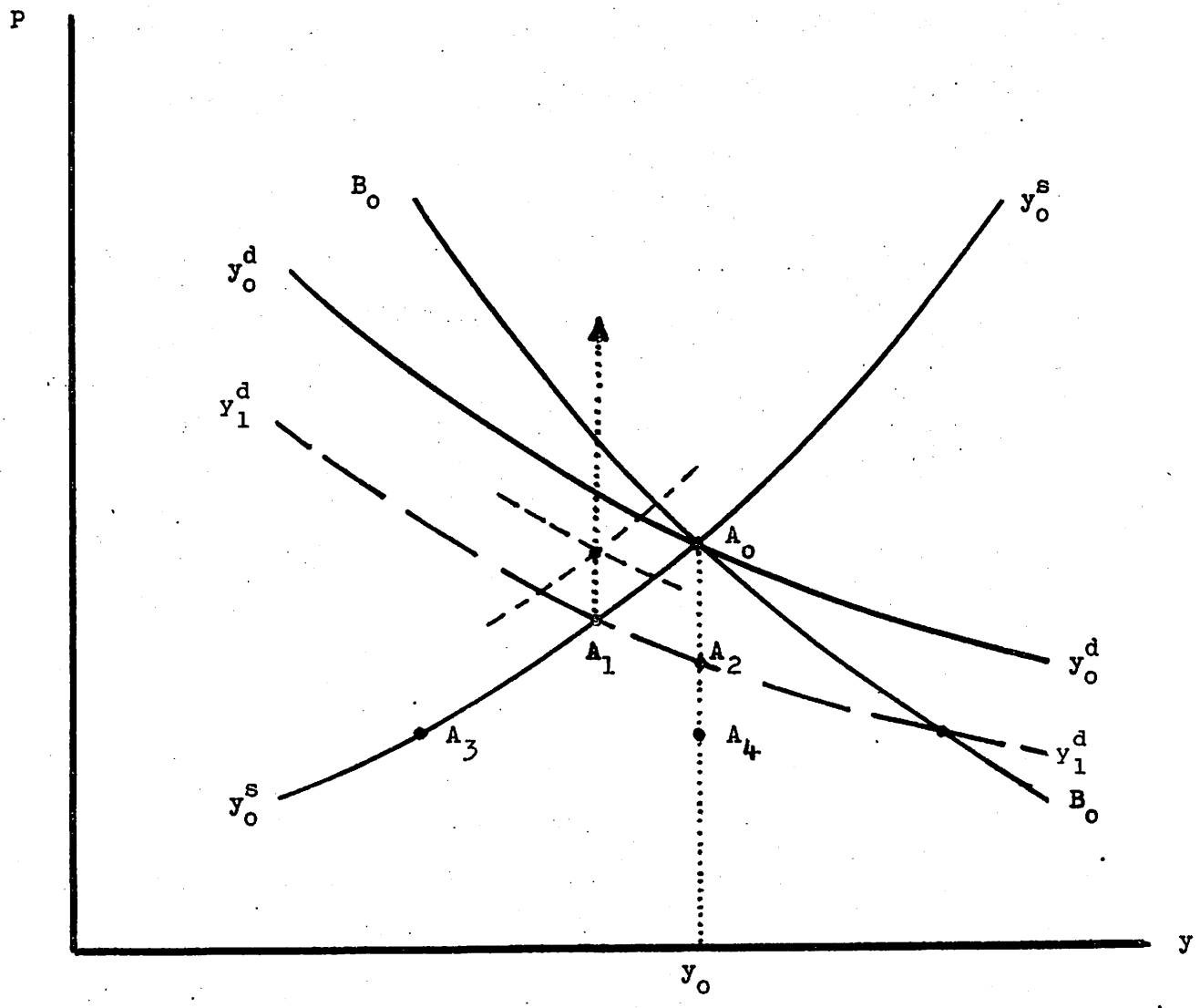

fig. 7

through a decline in domestic wages. In Figure 7 this policy would shift the $y_o^s y_o^s$ line to the right until point A_2 is reached. This policy would have a positive side effect on the domestic trade balance but, assuming the old output level y_o as a target, a wage policy on its own obviously incorporates a (weak) policy conflict. However, domestic policy makers also have a choice to employ a policy of changing domestic money supply. Applying that tool the reader may notice a strong policy conflict. Either the monetary authority cares about employment and increases the money supply such that point A_o is reestablished at the expense of a much larger domestic trade deficit or, with care to the trade deficit, a contractive money supply policy is applied which, at a point like A_3, may balance the trade account, but only at the expense of a deterioration in the domestic unemployment situation. It is clear now from this analysis of alternative policy tools that a solution to the problem can be found only by invoking one of Tinbergen's policy prescriptions. In our case, we steer the domestic economy by a policy mix of nominal wage restraint and a tight money supply which would give us point A_4 as an indication of a successful stabilization.

Two things are worthwhile to observe. First is the pattern of using available policy instruments, namely nominal wage restraint and tightening of the money supply, to attain policy goals. Secondly, it is quite obvious that what we have described in terms of a necessary activity of a policy authority is the same outcome which would be generated by a mechanism some authors like to name the 'classical international adjustment mechanism'.[31] Under this mechanism y_o plays the role of full employment output. Under the assumption of a 'market flexible' nominal wage, the temporal automatic

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[31] See Dornbusch and Fischer (1978), Ch. 18. See also the dynamic small country model by Henderson (1980).

adjustment mechanism becomes a reduction in (or in case of a positive rate of productivity growth a slowing in the rate of increase of) nominal wages in the face of unemployment pressure, accompanied by a reduction in the domestic money supply via the domestic trade deficit.

It is of utmost importance to have in mind this classical adjustment mechanism when finally we apply our model to a comparative static explanation of a vicious circle phenomenon. Within our limited framework it is possible to explain a vicious circle as a policy failure, such that available policy tools are applied in exact opposition to the way they would be used in the context of the classical adjustment mechanism. As we have seen, point A_1 is the outcome of a foreign disturbance under a fixed exchange rate and downward rigidity of domestic nominal wages. Because of the enlarged unemployment at A_1 compared to A_o, assume the monetary authority enacts or is forced to pursue an expansive monetary policy aimed at a reduction of unemployment, of course, with the side effect of raising the goods price level. To cover the balance of payments flank it is conceivable that the monetary expansion is validated by a devaluation of the domestic currency. This concerted monetary activism shows up in Figure 7 as an upward shift of the $y_1^d y_1^d$ line, and obviously it is accompanied by a faster rising domestic price level. Assuming now real wage resistance on the part of domestic trade unions, this price increase leads to higher domestic nominal wages, which is to say $y_o^s y_o^s$ in Figure 7 shifts upwards. At rising prices, wage rates, and a continuous devaluation, the domestic economy now may find itself in an unemployment trap, which we have depicted in Figure 7 as a vertical arrow originating at point A_1.

7. Qualifications and Concluding Remarks

The purpose of this paper was to provide a synthesis of the monetary and Keynesian approaches. This was done by developing a very simple general model of the determination of output, prices, and the balance of trade. Within this general model there is no antagonism between the Keynesian and the monetary approaches. Moreover in doing this we have expressed our conviction that there is also no antagonism between a 'cost push' and 'demand pull' doctrine. Macroeconomic theory should model the two blades of the price seissors without ideological blinders. We have tried to present useful ecclecticism by pulling together different approaches and geometric techniques from the literature to show that they can be used in a consistent way. The resulting hybrid model can be regarded as interconnecting income expenditure theory, neo-quantity theory, and cost push theory. We have some reservation about this model with respect to two major shortcomings: first, we considered money as the only form of wealth, thereby excluding alternative assets and consequently opportunity costs of holding money. Second the model is comparative static and there should be a dynamic formulation of the adjustment process concerning the price and quantity adjustment as well as wealth accumulation. It is obvious, on the other hand, that the model is deliberately built on a minimal format. It is of course at the expense of additional algebraic complexity to extend the model to incorporate fiscal activity (Brunner (1976)) or more than one good on the consumption side (Dornbusch and Fischer (1978a) or Henderson (1980)) as well as on the production side.

8. Appendix: Comparing Stock and Flow Approaches

Dornbusch's (1973) presentation of the monetary approach as well as other expositions (see, e.g., Brunner (1976)) emphasize a stock approach. This is underlined also by not using the more familiar eq. (20) to represent goods market equilibrium but rather the eq. (25) which we have seen is equivalent to (20). Inserting the hoarding function (12) and its foreign counterpart into (25) and differentiating yields the following.

$$\lambda\mu[\hat{P} + \hat{y} - \hat{M}] + \lambda^*\mu^*[\hat{P} + \hat{y}^* - \hat{E} - \hat{M}^*] = 0$$

$$dB = \lambda M[\hat{P} + \hat{y} - \hat{M}]$$

The adjustment parameters λ, λ^* have a suitable dimension in order to relate stocks and flows. The same purpose is served if we use our hoarding parameter ρ,ρ^* and the velocity ν,ν^* in the following identities, $\lambda = \rho\nu$ and $\lambda^* = \rho^*\nu^*$. Note further that by assumption production is constant in both countries, hence we get the following system for the short-run impact.

$$\begin{bmatrix} \rho\nu\mu + \rho^*\nu^*\mu^* & 0 \\ \rho\nu\mu & -(1/E\bar{M}^*) \end{bmatrix} \begin{bmatrix} \hat{P} \\ dB \end{bmatrix} = \begin{bmatrix} \rho\nu\mu & \rho^*\nu^*\mu^* & \rho^*\nu^*\mu^* \\ \rho\nu\mu & 0 & 0 \end{bmatrix} \begin{bmatrix} \hat{M} \\ \hat{M}^* \\ \hat{E} \end{bmatrix}$$

$$D = -(1/E\bar{M}^*)\Delta < 0$$

$$\Delta = \rho\nu\mu + \rho^*\nu^*\mu^* > 0$$

$$\mu = M/E\bar{M}^*; \quad \mu^* = M^*/\bar{M}^*; \quad \bar{M}^* = (1/E)M + M^*$$

Note that in Dornbusch's presentation the shares of national money stocks in the world money stock, μ, μ^*, play an important role. This is to say distribution of the world money stock--a characteristic of the world economy's asset sector--is influential in the determination of the price and trade balance effects of a devaluation. While it is nice to have a property of the asset sectors playing a role in determining variables traditionally related to flow

concepts, it seems to be at variance with our specification of the effects of a devaluation. The reader is reminded that in our formulas (34) we have parameters ξ, ξ^* which also refer to size. This time, however, it is the share of national incomes in world income, apparently a flow concept. It is possible to completely reconcile these seemingly different approaches if we assume the world economy initially is in a long run, i.e., stock and flow equilibrium. Then the flow and stock parameters are related to each other in the following way.

$$[\nu\mu + \nu^*\mu^*]\xi = \nu\mu \quad \text{and} \quad [\nu\mu + \nu^*\mu^*]\xi^* = \nu^*\mu^*$$

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