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EXCHANGE RATE RULES AND MACROECONOMIC STABILITY

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Exchange Rate Rules and Macroeconomic Stability

ABSTRACT

This paper discusses exchange rate rules in their role as macroeconomic instruments. Two quite different approaches are pursued. The traditional view is that exchange rate flexibility is a substitute for money wage flexibility so that managed money and managed exchange rates yield the necessary instruments for internal and external balance.

An entirely different perspective is offered by the modern macroeconomics of wage contracting and the longrun trade-off between the stability of output and the stability of inflation. In this context it is shown that exchange rate policies that seek to maintain real exchange rates or competiveness do stabilize output but do so at the cost of increased inflation instability. Exchange rate rules such as full purchasing power parity crawling pegs are the analogue of full monetary accomodation of price disturbances.

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EXCHANGE RATE RULES AND MACROECONOMIC STABILITY*

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I. INTRODUCTION:

This paper discusses exchange rate rules in their role as macroeconomic instruments. We abstract throughout from the trend part of exchange rate behaviour-- a crawling peg necessitated by differences in trend inflation-- and emphasize instead the implications of exchange rate rules in providing flexibility of real wages or in affecting the stability of output or prices.

Two quite different approaches are explored. In Part II we study the Hahn-Meade perspective where approaches to full-employment and external balance are considered for various combinations of active money and exchange rate management. Here exchange rate policy is seen in terms of the implications for the dynamics of adjustment to situations of disequilibrium. The conclusion is that active money and active exchange rate policy lead to complete control of the relevant macroeconomic instruments and thus potentially to optimal policy making. There are as yet no costs to discretionary stabilization policy.

Part III approaches exchange rate rules from the perspective of modern Phelps-Friedman macroeconomics. Policy is set in a stochastic macromodel and the question is asked how alternative exchange rate and money rules affect the stochastic (steady state) properties of the economy. Costs of reduced output variability through non-discretionary active money and exchange rate policies are shown. The costs of active accommodation policies lie in the increased persistence in output and prices.

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There is no integration of the two approaches. They largely represent different views of the economy. One emphasizes the shorturn and the optimism that accommodation, just once, cannot but be a blessing. The other does not contemplate the isolated initial condition of "obvious" need for accommodation but rather asks how an economy behaves where on average policies are accommodating. The perspective is very much a longrun one, but needless to say,a long period of repeated accommodation cannot but generate the expectation that such is the policy rule.

II. MONEY, WAGES AND EXCHANGE RATES

In this section we present a first pass at the problem of exchange rate arrangements by looking at the dynamics of a simple model of a small open economy. To keep to essentials we look only at the interactions of money, wages and the exchange rate, leaving aside issues of financial markets. We also set aside for the present issues of expectations.

The Model:

The economy we study is one that produces only exportables and faces an imperfectly elastic world demand for these goods. In the world market importables--intermediates and final goods-- are available in perfectly elastic supply. Home employment is demand determined at a given wage that responds over time to the state of the labor market. Home prices are cost-based. Domestic aggregate spending depends on real income and the real value of money. The composition of home spending between imports and domestic output depends on relative prices.

Employment at home is demand determined. With a constant coefficient production function employment, L, is determined by the level of home demand, D, plus foreign demand M*:

$$L = a(D + M^*) \tag{1}$$

where a is the unit labor requirement.

Prices of domestic output, P_X, are determined by unit labor and material costs:

$$P_X = aW + bE \tag{2}$$

where W is the money wage and E is the exchange rate that proxies the domestic currency price of imported intermediate goods.

We define next the relative price of domestic goods in terms of the price level. The latter is a geometric average of home and import prices:

$$(3) \qquad P_x/P(P_x,E) = \theta(W/E) \qquad \theta' > 0$$

where the elasticities of P are given by the expenditure shares of domestic goods and imports respectively.[1] Using (2) it is apparent that the relative price of domestic goods rises as the wage rate rises relative to the exchange rate or as we have a "real appreciation".

The relative price of domestic goods in terms of foreign goods, P_x/E, is given from (2) as:

$$(4) \qquad P_x/E = a(W/E) + b$$

and is accordingly an increasing function of the $W/E \equiv w$ ratio.

With the relative price definitions we can turn to the demand side of the economy. In the home country final demand depends on relative prices, P_x/P, real income WL/P, and real balances, H/P:

$$(5) \qquad D = D(P_x/P, WL/P, H/P); \qquad M=M(P_x/P, WL/P, H/P)$$

Exports depend on our prices relative to those abroad:

$$(6) \qquad M^*=M^*(P_x/E)$$

We complete the static model with the trade balance equation:

$$(7) \qquad B = P_x M^* - EM - bE(D+M^*)$$

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[1] With a Cobb Douglas price index $P= P_x^s E^{1-s}$, with s is the expenditure share of exportables, the relative price is:
$P_x/P = (aW+bE)/(aW+bE)^s E^{1-s} = (aW+bE)^{1-s}/E^{1-s} = (aw+b)^{1-s} = \theta(w)$

Equilibrium:

There are three state variables in our system: wages, the exchange rate and the nominal money stock. The real equilibrium is homogeneous of degree zero in these three variables. We thus can solve for the level of employment, L, and for the real balance of trade, $\tilde{B}$, in terms of the real wage, $W/E \equiv w$, and the real money stock, $H/E \equiv h$:[2]

$$L = L(w,h) \qquad L_w < 0 \quad L_h > 0 \tag{8}$$

and

$$\tilde{B} = \tilde{B}(w,h) \qquad \tilde{B}_w < 0 \quad \tilde{B}_h < 0 \tag{9}$$

We assume in (8) and (9) that a rise in the real wage and hence in the relative price of domestic goods lowers demand for domestic goods and employment and worsens the balance of trade. A rise in the real money supply expands demand, raises employment and worsens the trade balance.

In Figure 1 we show the static model. The schedule LL shows combinations of real wages and real money such that the demand determined level of employment is equal to the existing labor force. Along LL we thus have fullemployment. Above and to the left there is unemployment and below and to the right there is overemployment. Along BB we have balanced trade. Above and to the right the level of spending or the relative price of domestic goods are too high so that there is a deficit; below and to the left of BB there are is a surplus. At point Q we have internal and external balance.

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[2] We use the term "real" here to refer not to the variables deflated by the price level but rather by the exchange rate.

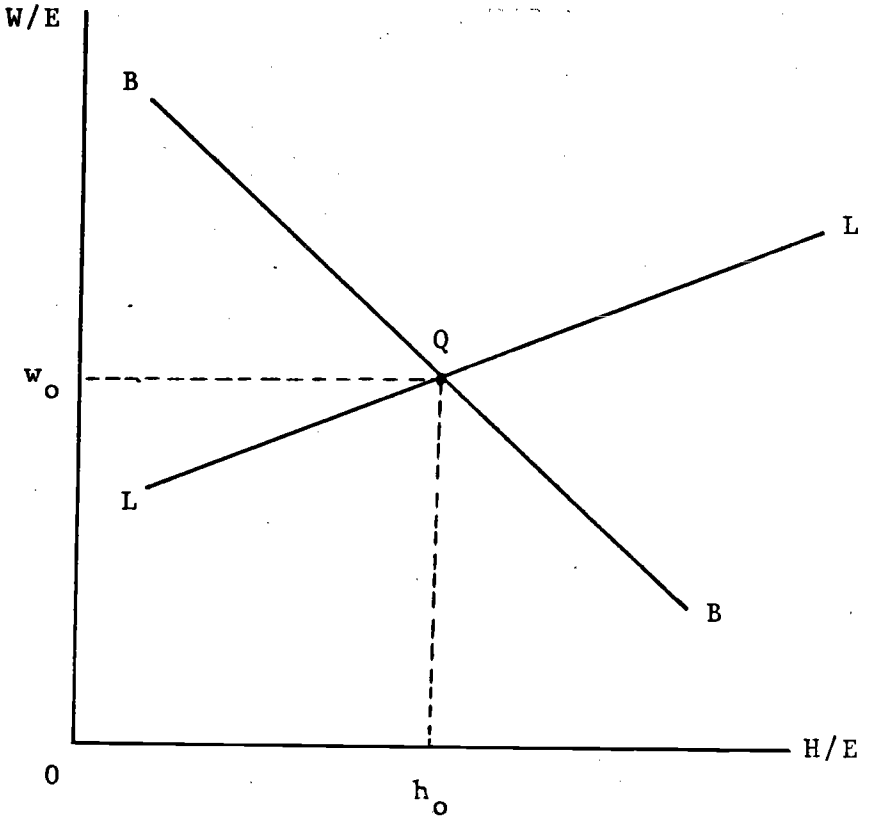

FIGURE 1

Dynamics:

We turn now to the adjustment process that governs the economy when it is outside full equilibrium at Q. We assume throughout that money wages adjust slowly and in response to labor market disequilibrium. The remaining dynamics are then controlled by the monetary and exchange rate policies that are pursued. Table 1 shows the possible combinations of fixed settings, balance of payments determined settings and actively managed settings.

		EXCHANGE RATE		
		Fixed	BoP	Managed
MONEY	Fixed	I	II	III
	BoP	IV	V	VI
	Managed	VII	VIII	IX

TABLE 1: POLICY REGIMES

The pure regimes are, of course, the fixed rate-gold standard variety that is shown as IV and the flexible rate, fixed money case of II. They are shown in Figure 2 as possible adjustment processes. Starting from a point of unemployment and surplus the flexible rate regime implies an immediate appreciation to restore external balance and a subsequent adjustment via wage reduction until point Q is reached. Fully flexible rates thus imply that the immediate appreciation will, in the first place, worsen the employment situation since it involves an appreciation A to A'.

Adjustment under a fixed rate with monetary discipline is shown by the path originating at A. The path involves wage adjustment to achieve competitiveness and wage and money adjustment to gain external balance. Wages will fall in response to unemployment above the LL line and the money stock will rise in response to the balance of payments surplus below and to the left of the BB line. The adjustment here may be cyclical.

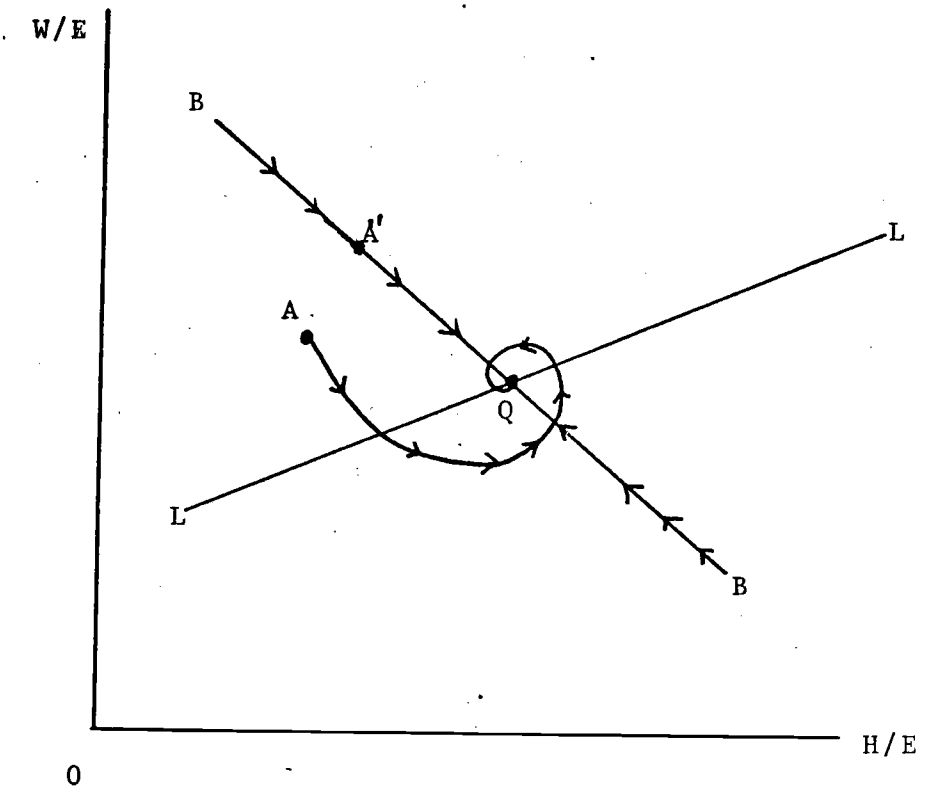

FIGURE 2

A third possibility is a regime of managed money and fixed rates or flexible rates with managed money. The latter is also shown by a path along the BB schedule in Figure 2, but it involves an adjustment process that is faster then under fixed money and flexible rates. It thus clearly dominates the latter regime, since it uses a "free" instrument to accelerate the return to fullemployment.

The fixed rate with managed money is shown in Figure 3 by a path originating at A. With a monetary rule linked both to the balance of trade and to employment we have:

$$\dot{h} = \tilde{B}(w,h) + \phi(\bar{L}-L(w,h)) \tag{10}$$

so that unemployment leads to an expansion in money over and above what arises from the automatic balance of payments process. The case is shown in Figure 3 where $\dot{h}=0$ corresponds to zero money growth in the managed system. The approach to the equilibrium at Q may either be direct or, with a monetary policy that is strongly employment oriented, a clockwise half-cycle.[3]

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[3]To ensure stability we require that the $\dot{h}=0$ schedule not coincide with the LL schedule since otherwise we would not converge to longrun external balance.

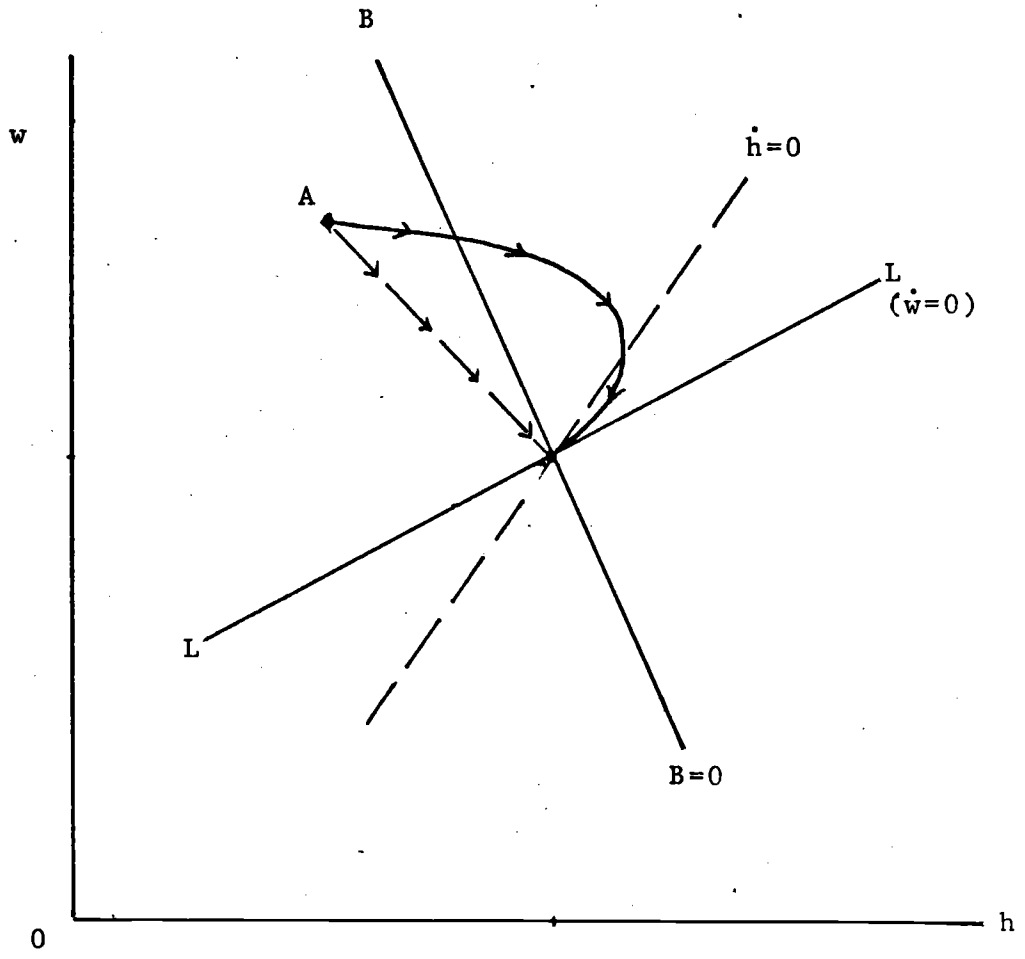

FIGURE 3

Managed Exchange Rates:

The managed exchange rate and managed money case represents a yet improved arrangement. Here the authorities control directly the rate of change of the real variables w and h that matter for external balance. Given the adjustment process for money wages; the possibility of choosing both the exchange rate movement and that of money implies that the authorities can chose the evolution of both real wages and real money:

$$\dot{w} = \alpha(w,h) \quad \text{and} \quad \dot{h} = \beta(w,h) \tag{11}$$

The functions $\alpha(w,h)$ and $\beta(w,h)$ can be chosen so as to maximize social welfare and improve on the path of the mixed systems of fixed or flexible rates with managed money. The system can be chosen to be more employment oriented then the alternative arrangements discussed above. That advantage arises here from the central feature of a managed rate namely that it makes the rate of change of the real wage a policy instrument.

The advantage of the fully managed system can be seen, for example, by comparison with the fixed rate- managed money system. In the latter case a policy highly oriented toward employment requires an overshooting of domestic demand. Given a position of initial unemployment and surplus the policy involves falling wages and money creation. Money creation proceeds rapidly and continues even while the external balance goes into deficit. The creation and maintenance of domestic demand through money creation ultimately has to give room to employment created through increased competitiveness; there will thus be a reversal when the deficit becomes dominant and money is being contracted while the continuing decline in real wages generates increasing employment and increasing net exports. A fully managed system could shape the dynamics to avoid such an overshooting.

Lags:

The stabilizing potential of a fully managed system can also be appreciated if we recognize the possibility of adjustment lags. Suppose in particular that the substitution in response to a relative price change is not achieved instantaneously but rather occurs gradually. In that event employment and the trade balance can be written as a function of both actual real wages, w, and the variable $\bar{w}$ which governs substitution and can be interpreted as the longrun expected real wage:

$$(12) \qquad L = L(w,\bar{w},h) \qquad L_w>0, \quad L_{\bar{w}}<0, \quad L_h>0;$$
$$\tilde{B} = \tilde{B}(w,\bar{w},h) \qquad \tilde{B}_w>0 \quad \tilde{B}_{\bar{w}}<0 \quad \tilde{B}_h<0$$

In (12) the income effect of a rise in the real wage raises employment and improves the trade balance; the substitution effect worsens employment and the trade balance. The net effect of an equiproportionate rise in w and $\bar{w}$ is assumed, as before, to be a reduced level of employment and a worsening of the external balance.

We combine the employment and trade balance equations in (12) with an adjustment rule for expectations:

$$(13) \qquad \dot{\bar{w}} = g(w-\bar{w})$$

It is immediately recognized that this system under fixed rates and monetary "discipline"involves the possibility of instability. An increase in wages improves the external balance and leads to an increase in money which raises employment and thus contributes to a further wage inflation. With substitution slow and induced import spending small there is a possibility of instability. Under flexible rates the system would certainly

possess the potential for instability since now wage inflation leads in the first place to appreciation but appreciation only further raises real wages and widens the external imbalance.

The managed exchange rate system can be used in this context to stabilize the system and assure convergence; it avoids the massive exchange rate movements implied by the J-curve under flexible rates and the uncertainty about stability under fixed rates.

With incomplete information on the structure of the economy Mundell's idea of the principle of effective market classification becomes helpful. To achieve stability we want to gear the instruments,and their speeds of adjustment, in the manner suggested by (11)':

$$(11)' \quad \dot{w} = \delta(L(w,\bar{w},h) - \bar{L}); \; \dot{h} = \gamma\tilde{B}(w,\bar{w},h)$$

Actively managed money and real exchange rates here compensate for the potential instability arising from the J-curve. Of course, more complicated rules, requiring more information on the structure of the economy, can take into account balance of payments constraints or employment objectives in the adjustment process.

Summary:

The advantage of a managed rate system that was pointed out concerns the gain of an extra policy instrument involved in the managed flexibility. The authorities gain control over the rate of adjustment of real wages and can thus stabilize a system that would otherwise be unstable or chose a path that involves higher employment or smaller deficits then would be possible under alternative managed systems.

So far the extra flexibility has come without cost. These costs arise possibly from the incompatibility of the exchange rate rule with financial stability, from confidence about the discretion that is involved or from adverse feedback of the exchange rate path--compared with fixed or flexible

III. EXCHANGE RATE RULES, PERSISTENCE OF INFLATIONARY SHOCKS AND ECONOMIC STABILITY.

In this part we draw on the modern macroeconomics of contracting and rational expectations, in particular the exciting formulation by Taylor {1979}. We approach the question of exchange rate rules in the context of a stochastic macroeconomic setting. In that context we show that an exchange rate rule along purchasing power parity lines {PPP for short} with an adjustment for external imbalance, will reduce the variability of output but will also, through its effects on wage contracts, lengthen the persistence of inflationary shocks.

The literature on exchange rate rules in a stochastic setting started with Fischer {1976} who discussed fixed versus flexible rates as exchange rate regimes in economies with nominal and real shocks. Subsequent work along these lines includes Enders and Lapan {1978}. Barro {1978} extended the Lucas model to an open economy and contributions by Frenkel {1976} and Weber {1978} addressed the question of optimal intervention rules, as did Boyer {1978}. In particular the distinction between nominal and real shocks receives emphasis in this context and, in line with the original Lucas model, there is little scope for persistence. An alternative approach is suggested here by looking not only at the relation of the exchange rate rule to stability of output and relative prices, but also at the costs in terms of increased persistence of shocks.

Taylor's contribution is of importance in the context of exchange rate rules because a policy of accommodating price level disturbances, as is implied by a PPP rule, will in a setting of overlapping longterm wage contracts imply that labor need be less concerned with the unemployment effects of high wage settlements and that accordingly price disturbances will be more fully reflected in wages and therefore in future prices.

A PPP policy, just as an accommodating monetary policy in Taylor's model, will tend to increase the persistence of price disturbances. To the extent that the exchange rate reacts to trade imbalance, in addition or in place of a direct PPP rule, there will also be a contribution to the stability of output, but again at the cost of increased persistence of inflationary shocks.

1. The Model

The basic model is a log-linear rendition of the small open economy that faces given world prices, but has a downward sloping demand for her exports. Output is demand determined given the price is set by longterm wage contracts. The model, in terms of deviations from trend, follows:

$$y = f\{e-p\} + g\{m-p\} + v \quad \{14\}$$

$$T = f\{e-p\} - ky + v \quad \{15\}$$

$$m = \theta p \quad \{16\}$$

$$e = \delta p - \eta\{f(e-p)+v\} \quad \{17\}$$

Equation {14} shows the aggregate demand function. Relative prices {e-p}, real balances {m-p}and a white noise shift term,v, determine the level of demand for domestic output. Equation {15} shows the external balance depending on relative prices, income and again the shift term, v, which thus represents a shift in demand toward domestic output and associated trade surplus.

The policy rules are shown in equations {16} and {17}. In equation {3} nominal money is shown to respond with elasticity θ to price shocks. The exchange rate, in{17}, is set by reference to the price level and the cyclically adjusted trade balance.[1]

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[1]The cyclical adjustment is appropriate because the income variable is a noisy signal for the appropriate direction of exchange rate change. A trade improvement might arise from a negative supply shock or from a demand shift of from a fall in aggregate demand.

Solving the system for the real exchange rate from {17} yields:

$$\{18\} \quad e-p = -\pi\{1-\delta\}p - \eta\pi v \qquad ; \ \pi \equiv \frac{1}{1 + f\eta}$$

Substituting the real exchange rate and the money rule in the aggregate demand functions yields the equation for output:

$$\{19\} \quad y = - \phi p + \pi v \qquad ; \quad \phi \equiv f\{ 1-\delta\}\pi+g \{1-\theta\}$$

The output equation shows that an increase in price will reduce output unless there is full PPP and full money accommodation. This is, of course, a standard result for a homogeneous system. The equation also reveals that the impact of price shocks on demand is mitigated by the exchange rate feedback. The price drange mitigates the adverse effects directly through the partial PPP accommodation but also through the impact of the exchange rate on the trade balance and thus on the exchange rate. The term π measures the dampening effect of the feedback of price disturbances via the trade balance on demand.

The trade balance feedback on the exchange rate serves also to dampen the impact of demand shifts on output. A demand shift improves the trade balances and thus leads to an appreciation. The induced appreciation dampens the impact of the demand shift on output.

Consider next the variability of output and relative prices that is generated by the disturbances and their interaction with the policy instruments. The variance of output and relative prices are respectively σ_y^2 and σ_z^2 :

$$\{20\} \quad \sigma_y^2 = \phi^2\sigma_p^2 + \pi^2\sigma_v^2 \qquad \sigma_z^2 = \pi^2\{1-\delta\}^2\sigma_p^2 + \eta^2\pi^2\sigma_v^2$$

where σ_p^2 is the {asymptotic} variance of price to be discussed later. From {20} it is apparent that the variability of output will be more or less than that of relative prices depending on the extent of monetary accommodation, θ , and on the relative price elasticity of demand. Little accommodation and a high price elasticity tend to raise the variability of output relative to that of relative prices.

Equations {20} suggest the possibility of choosing policy parameters with a perspective of minimizing the variability of output or relative prices. That approach is not pursued here because, as {20} shows, there is no trade-off as yet. The next step is to draw on Taylor's work to show that policies which reduce the variability of output and relative prices are also policies that raise the persistence of disturbances, and raise the variability of prices.

2. Pricing a la Taylor:

Taylor's model of output and price determination assumes two-period, overlapping labor contracts. Labor contracts currently entered into set the wage, x, with reference to existing contracts, x_{-1}, expected new settlements, $\hat{x}_{+1}$, and expected excess demand $\hat{y}$ and $\hat{y}_{+1}$ during the length of the contract. A $\hat{}$ denotes here an expectation, given the model and information available at time t-1. The wage rule studied by Taylor is:

$$\{21\} \quad x = bx_{-1} + d\hat{x}_{+1} + \gamma\{b\hat{y} + d\hat{y}_{+1}\} + u \; ; \qquad b \equiv 1-d$$

The wage determination process emphasizes both the relative wage argument and cyclical effects on wages. Rational expectations are introduced to allow for unbiased forecasts of excess demand levels and future settlements. The term u is white noise in the wage process.

Prices are determined on the basis of wages. In particular prices are set equal to the "average", wage, $.5\{x+x_{-1}\}$:

{22} $p = .5\ \{x+x_{-1}\}$

Taylor shows that if aggregate demand can be written as:

{23} $y = -\beta p + v$

where β equals unity less the coefficient of monetary accommodation, then from {21},{22} and {23} the stochastic steady state wage process is:

{24} $b\hat{x}_{-1} - c\hat{x} + d\hat{x}_{+1} = 0 \qquad ; \quad c \equiv \{1+.5\gamma\beta\}/\{1-.5\gamma\beta\}$

and the price process is:

{25} $p = \alpha p_{-1} + .5\{u + u_{-1}\} ; \qquad \alpha \equiv \{1/2d\}\{c - \{c^2-4d\{1-d\}^{.5}\}$

Taylor notes that increased accommodation, by reducing β, will stabilize output. But, and this is the point of his paper, there is a cost in terms of an increased persistence in the effect of a disturbance. This is so because the coefficient α in the price equation is a function of the policy parameter β.

For subsequent reference we note the asymptotic variance of price:

{26} $$\sigma_p^2 = \frac{1/4}{\{1 - \alpha^2\}}\{2 + \alpha\}\sigma_u^2; \qquad \alpha = \alpha\{\beta\}; \quad \alpha' < 0$$

3. Extension to The Open Economy:

While the structure of the model developed in section 1 above is more complicated than the Taylor economy it is still obvious that the reduced form equation for output in {6} is of the same form as {23}. Accordingly we can directly borrow Taylor's price equation. The only change we have to make is the substitution of the parameter ϕ in place of his β.

With this adaptation, and with α as the measure of the persistence of disturbances, the following results will hold: First, exchange rate policy that follows a PPP pattern is characterized by a value of δ close or equal to one. That policy, just as monetary accommodation in Taylor's model, will raise the persistence of disturbances. Second, an exchange rate feedback with respect to the trade balance, characterized by the π or η in our model, will again tend to raise the persistence of disturbances. Indeed, from the point of view of the persistence of price shocks it is immaterial whether the accommodation arises through monetary accommodation, PPP exchange rate accommodation or through the effect of trade imbalance on the exchange rate.

The persistence of disturbances in their impact on output can be noted by substituting the price equation in {12}, with $\alpha=\alpha\ \{\phi\}$, into the output equation in {6}to obtain:

$$\{27\} \quad y = \alpha y_{-1} - .5\phi\{u+u_{-1}\} + \pi\{v - \alpha v_{-1}\}$$

We note here that demand disturbances do not have a protracted effect on output, because they are not serially correlated. Wages are set before their realization and with an expectation that $E\{v\} = 0$. By contrast price disturbances do affect output over time, and it takes output below normal to depress the wage and price level if it has risen above normal.

In summary then, an exchange rate rules like {17}with a partial PPP aspect and a feedback to the current account will raise the persistence of disturbances over time both with respect to output and with respect to prices; this must be seen as the cost of an exchange rate regime that attempts to maintain competitiveness and external balance. The regime does-- with the qualification noted earlier-- serve to lower the variability of output, but it does so at the cost of increased variability and persistence of prices.

There is some possibility for reducing output variance without raising persistence, though. We can maintain constant the term ϕ in {6} by raising the reaction of the exchange rate to the trade balance, η , thus reducing π, but choosing an offsetting reduction in δ or θ. With ϕ and hence persistence constant we still have the benefit of a reduction in the variance of both output and relative prices.

IV - CONCLUDING REMARKS

This paper has asked to what extent exchange rate flexibility or rules that link exchange rates to macroeconomic objectives can help stabilize the economy. As a first approximation we found that active exchange rate policy implies more flexibility in competitive positions and therefore potentially higher employment and a better trade position than would arise along a path governed by unemployment.

The next step was to recognize that active exchange rate policy, once it is recognized by the public, cannot but start affecting the wage-price process itself. In this context, drawing on Taylor's work, we showed that an accommodating exchange rate policy will enhance the persistence of disturbances, even though it dampens their variability. There is thus a clear trade-off. A more accommodating policy gives rise to protracted deviations from fullemployment and price stability.

The rational expectations perspective is an important reminder for policy makers of an activist persuasion (the good guys), because it draws attention to a clear-cut cost that has not received sufficient attention in the formal literature.

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