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Disinflation and Real Wages: An Alternative Approach

Comment on Agénor

CHING-CHONG LAI and WEN-YA CHANG*

IN A RECENT issue of *Staff Papers*, Agénor (1996) provides an excellent survey of the role of the labor market in the transmission process of adjustment policies in developing countries. In that paper, Agénor (1996) sets up a macroeconomic model embodying both backward- and forward-looking contracts and examines possible dynamic paths of the inflation rate and real wage in response to an exchange-rate-based stabilization program. He finds that, regardless of the types of wage contract, both the inflation rate and the rate of growth of nominal wages are equal to the devaluation rate in the long run.[1] This paper proposes an alternative model with a different price equation and shows that similar results in line with Agénor's finding will be obtained in this alternative model.

I. The Agénor Model

The Agénor (1996) model can be restated by the following equations:

$$\dot{\pi} = \kappa[c(\omega, z) - \bar{y}] + \sigma(\varepsilon^h - \pi), \text{ with } \kappa > 0, \quad 0 < c_\omega \leq 1, \quad c_z < 0, \text{ and } \sigma > 0, \tag{1}$$

$$\dot{\omega}/\omega = -\alpha(1 - \omega^{-1}) - \pi, \text{ with } \alpha > 0, \tag{2a}$$

* Ching-chong Lai is a Research Fellow at Sun Yat-Sen Institute for Social Sciences and Philosophy, Academia Sinica, and the Dean of the College of Business, Feng Chia University, in Taiwan. Wen-ya Chang is a Professor in the Department of Economics of Fu-Jen Catholic University in Taiwan. The authors would like to thank an anonymous referee for helpful suggestions and comments on an earlier version of the paper.

[1] Changes in the devaluation rate of domestic currency are closely related to the issue of exchange-rate-based stabilization programs. For a detailed discussion, see Agénor and Montiel (1996, Chaps. 8–10).

$$\dot{\omega}/\omega = \alpha(1 - \omega^{-1}) - \pi, \text{ with } \alpha > 0, \text{ and} \tag{2b}$$

$$c(\omega^*, z) = \bar{y}, \tag{2c}$$

where π = inflation rate, c = aggregate expenditure on commodity, ω = real wages, z = the long-run value of the relative price of the domestic good, $\bar{y}$ = capacity output, ε^h = rate of devaluation of the domestic currency, ω^* = the steady-state value of real wages, and an overdot denotes the time derivative.

Equation (1), which was popularized by Dornbusch (1982), specifies that changes in the inflation rate depend upon excess demand for commodities and the rate of depreciation of the real exchange rate. Consumption is assumed to depend positively on the current value of real wages and negatively on the long-run value of the relative price of the domestic good. Equation (2a) is a reduced form derived from the scheme in which wage contracts are backward looking, while equation (2b) is a reduced form derived from the scheme in which wage contracts are forward looking.[2] Equation (2c) indicates that the goods markets must be in equilibrium in the long run.[3]

Equation (2c) implies that the steady-state value of the relative price of the domestic good changes according to

$$d_z = -c_\omega d\omega^*/c_z. \tag{2d}$$

Let ω^* and π^* denote the stationary values of ω and π. In the context of backward-looking contracts, it follows from equations (1), (2a), and (2d) with $\dot{\pi} = \dot{\omega} = 0$ that

$$\begin{bmatrix} 0 & -\sigma \\ -\alpha\omega^{*-2} & -1 \end{bmatrix} \begin{bmatrix} d\omega^* \\ d\pi^* \end{bmatrix} = \begin{bmatrix} -\sigma d\varepsilon^h \\ 0 \end{bmatrix}. \tag{3}$$

By Cramer's rule, the impacts of ε^h on ω^* and π^* are

$$\partial\omega^*/\partial\varepsilon^h = -1\alpha\omega^{*-2}, \text{ and} \tag{4}$$

$$\partial\pi^*/\partial\varepsilon^h = 1. \tag{5}$$

Equations (4) and (5) indicate that in the long run a reduction in the rate of currency devaluation will lead to a rise in the real wage and an equal fall

[2] For detailed derivations of equations (2a) and (2b), see Willman (1988). See also Calvo (1983), Agénor (1996), and Agénor and Montiel (1996, p. 330).

[3] This long-run condition is necessary to ensure (as shown below) the equality in the steady state between the devaluation rate and the inflation rate in Agénor's model. Without it, the model would imply different steady-state values of inflation and the devaluation rate and would therefore possess an undesirable property: the real exchange rate would not be constant in the long run. The mechanism through which the equality between the steady-state values of inflation and the devaluation rate is obtained was left implicit in Agénor's (1996) analysis; here, we follow the presentation in Agénor and Hoffmaister (1997).

in the inflation rate. This further implies that a fall in the growth rate of nominal wages is matched by a fall in the rate of currency devaluation. It should be clear that the long-run condition in Agénor's model is perfectly valid—because there is an additional variable (in the background originally, but now made explicit), which is added to the long-run system. The key is that any long-run change in real wages has no steady-state effect on consumption because there is an offsetting change in the relative price, z.

The evolution of ω and π associated with backward-looking contracts can be illustrated by a diagram developed by Agénor (1996). In Figure 1, the II curve depicts all combinations of ω and π that satisfy $\dot{\pi} = 0$ in equation (1), and the WW curve portrays all pairs of ω and π that satisfy $\dot{\omega} = 0$ in equation (2a). From equations (1) and (2a), it is clear that the slopes of loci II and WW are

$$\partial\omega/\partial\pi|_{II} = \sigma/\kappa c_{\omega} > 0, \text{ and} \tag{6}$$

$$\partial\omega/\partial\pi|_{WW} = -\omega^{*2}/\alpha < 0. \tag{7}$$

As indicated by the direction of the arrows in Figure 1, the system displays the feature of global stability.[4]

In Figure 2, the initial equilibrium, where II intersects WW, is at E; the initial real wage and inflation rate are ω^* and π^*, respectively. When the government undertakes a disinflation program to lower the devaluation rate from ε^h to ε^s permanently, II will shift leftward to $I'I'$ while WW will remain intact. The new stationary equilibrium is established at point E', where $I'I'$ intersects WW. At the state of new equilibrium, the real wage will rise from ω^* to $\omega^{*\prime}$, and the inflation rate will drop from π^* to $\pi^{*\prime}$. These results are consistent with the comparative statics reported in equations (4) and (5).

With backward-looking contracts, at the instant of lowering the devaluation rate, neither inflation nor the real wage will adjust. The economy thus will remain at its initial position E. Thereafter, the economy will move along two possible dynamic paths toward its new long-run equilibrium E'. As is clear in Figure 2, the real wage displays a rising process. However, the inflation rate exhibits two possible patterns of adjustment over the time horizon. It may decline monotonically to its new stationary level (which is the only case analyzed by Agénor), but may also begin to fall at first and subsequently rise toward its new stationary level.

With forward-looking contracts, the dynamic path of the inflation rate and the real wage associated with a reduction in the rate of currency devaluation is the same as in the lower panel of Figure 5 in Agénor (1996). We thus need not repeat it here.

[4] The arrows of motion in the upper panel of Figure 4 in Agénor (1996) are incorrectly drawn. However, this does not affect in any substantive way Agénor's discussion on pages 296–97.

Figure 1. *Agénor Model: Backward-Looking Contracts Under Steady-State Equilibrium*

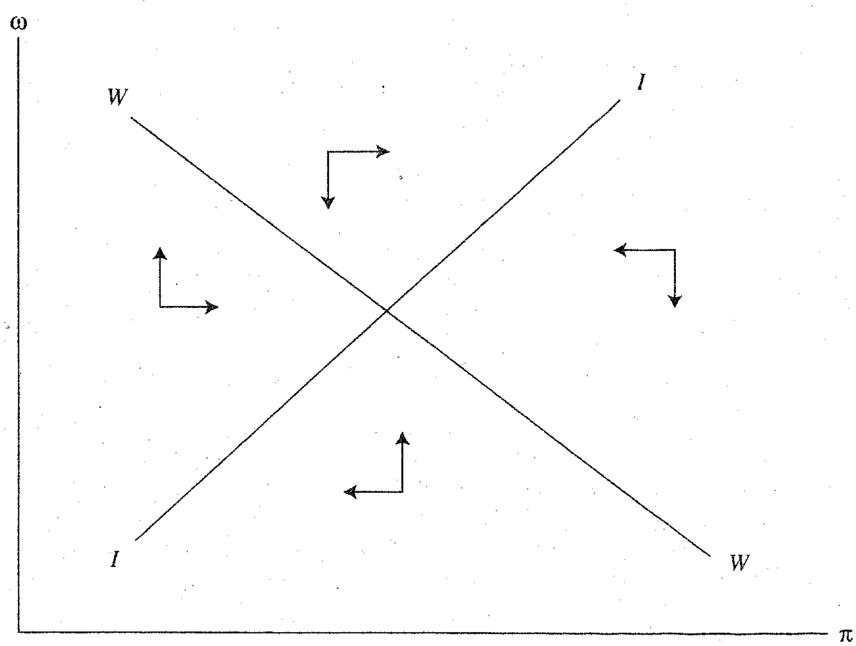
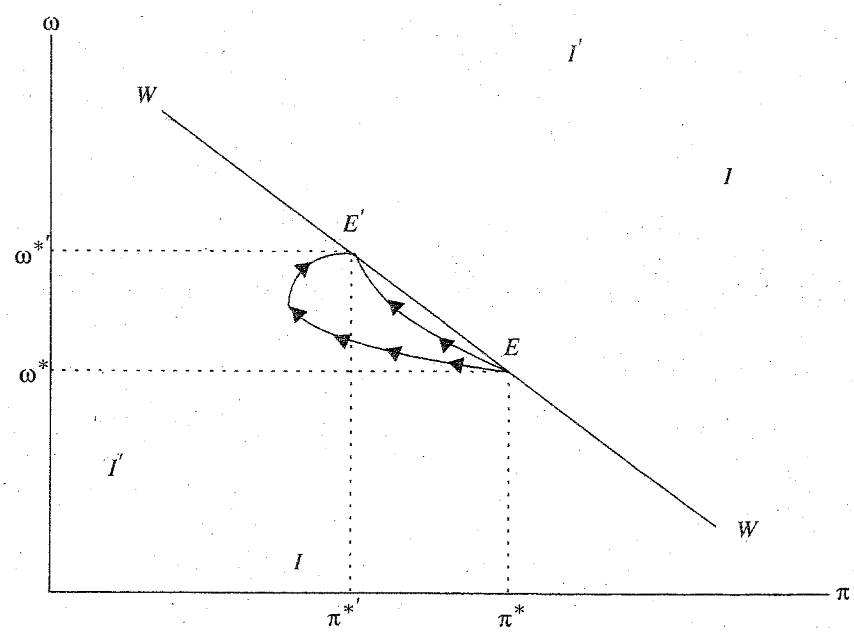


Figure 2. *Agénor Model: Backward-Looking Contract Under Disinflation and Real Wage Dynamics*



II. An Alternative Approach

In the previous section, we have shown that in Agénor's (1996) analysis a fall in the rate of currency devaluation leads to an equiproportional reduction in both the inflation rate and the growth rate of nominal wages. A key feature of the model is, of course, the long-run equilibrium condition (2c). Without it, as indicated earlier, the model would imply different steady-state values of inflation and the devaluation rate, and would therefore possess an undesirable property: the real exchange rate would not be constant in the long run.

This section tries to develop an alternative model, which does not require imposing goods market equilibrium in the long run, by adopting the Bhandari and Turnovsky (1982) viewpoint and shows that the constancy of the real exchange rate in the steady state will also hold in this model.

According to Bhandari and Turnovsky (1982), changes in the inflation rate are related to relative *time change*, rather than relative *amount*, between commodity demand and commodity supply.[5] That is, equation (1) should be specified as[6]

$$\dot{\pi} = \kappa[c_{\omega}\dot{\omega}] + \sigma(\varepsilon^{h} - \pi). \tag{8}$$

Because nominal wage contracts are formed as either backward looking or forward looking, we then deal with these schemes respectively.

Under backward-looking contracts, substituting equation (2a) into (8) yields

$$\dot{\pi} = \kappa c_{\omega}[-\alpha(\omega - 1) - \pi\omega] + \sigma(\varepsilon^{h} - \pi). \tag{9}$$

Equations (9) and (2a) constitute our alternative model in the context of backward-looking contracts. Let $\hat{\omega}$ and $\hat{\pi}$ be the steady-state values of ω and π of the alternative model. From equations (9) and (2a), we then have

$$\begin{bmatrix} \kappa c_{\omega}\alpha\hat{\omega}^{-1} & (\sigma + \kappa c_{\omega}\hat{\omega}) \\ \alpha\hat{\omega}^{-1} & \hat{\omega} \end{bmatrix} \begin{bmatrix} d\hat{\omega} \\ d\hat{\pi} \end{bmatrix} = \begin{bmatrix} \sigma d\varepsilon^{h} \\ 0 \end{bmatrix}. \tag{10}$$

[5] In common with the existing literature, including Dornbusch (1976) and Frenkel and Rodríguez (1982), it is plausible to postulate that the change of prices (and, hence, inflation) depends upon excess demand for commodity. Based on such a postulation, the time change of inflation should be related to the time change of excess demand for commodity.

[6] If we adopt Bhandari and Turnovsky's (1982) specification, equation (1) should be modified to $\dot{\pi} = \kappa[dc(\omega, z)/dt - d\bar{y}/dt] + \sigma(\varepsilon^{h} - \pi)$, where t denotes the time. Given that z is the long-run value of the relative price of the domestic good and output is fixed at its capacity level $\bar{y}$, $dc(\omega, z)/dt = c_{\omega}\dot{\omega}$ will hold. As a result, the above equation can be alternatively expressed by equation (8).

The effects of a change in ε^h on $\hat{\omega}$ and $\hat{\pi}$ thus are given by

$$\partial\hat{\omega}/\partial\varepsilon^h = -\hat{\omega}^2/\alpha < 0, \text{ and} \tag{11}$$

$$\partial\hat{\pi}/\partial\varepsilon^h = 1. \tag{12}$$

Equations (11) and (12) tell us that a reduction in the devaluation rate will result in a rise in the stationary real wage and an equal fall in the stationary inflation rate. These results further reflect the equivalence in the long run of the growth rate of nominal wages and the inflation rate. Therefore, Agénor's (1996) result that the inflation rate and the growth rate of nominal wages exhibit an equal change with the rate of currency devaluation remains valid. Moreover, equation (12) also implies that the level of the real exchange rate is constant in the new steady state.

We are now ready to study the transitional process of ω and π when there is a reduction in the devaluation rate of domestic currency. We can infer from equation (9) with $\dot{\pi} = 0$ that the slope of the II schedule is

$$\partial\omega/\partial\pi|_{II} = -(\sigma + \kappa c_\omega\hat{\omega})/\kappa c_\omega\alpha\hat{\omega}^{-1} < 0, \tag{13}$$

while the slope of the WW locus is the same as that of Agénor's model. The slope of the WW schedule is $\partial\omega/\partial\pi|_{WW} = -\hat{\omega}^2/\alpha < 0$.

In Figure 3, the economy initially is established at point E, where the II locus intersects the WW locus. Following a reduction in the devaluation rate from ε^h to ε^s, the II schedule will shift leftward to $I'I'$ while WW will remain intact. The new stationary equilibrium occurs at point E', where $I'I'$ intersects WW. At the new steady state, the real wage will rise from $\hat{\omega}$ to $\hat{\omega}'$, and the inflation rate will decline from $\hat{\pi}$ to $\hat{\pi}'$.

Given that wage contracts are backward looking, at the moment of lowering the devaluation rate, both ω and π will stay at their initial levels. Thereafter, the economy will move from E along the dynamic path marked with arrows toward its new stationary equilibrium E'. As depicted in Figure 3, the real wage keeps rising while the inflation rate keeps falling during the adjustment interval. The adjustment path described in Figure 3 is thus qualitatively similar to the monotonic path predicted by Agénor's model.

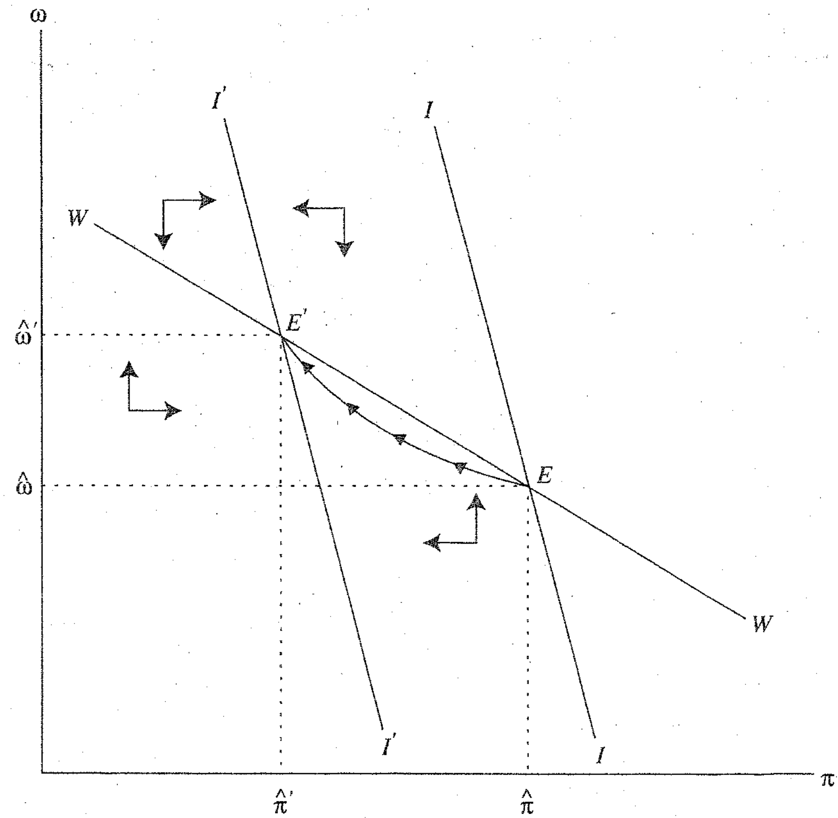
We now turn to discuss the situation in which the wage formation scheme is forward looking. In the context of forward-looking contracts, substituting equation (2b) into (8) yields

$$\dot{\pi} = \kappa c_\omega[\alpha(\omega - 1) - \pi\omega] + \sigma(\varepsilon^h - \pi). \tag{14}$$

The system of equations (2b) and (14) can be solved again for two endogenous variables: ω and π. At steady state, $\dot{\omega} = \dot{\pi} = 0$ and ω and π are at their stationary levels $\hat{\omega}$ and $\hat{\pi}$. It follows from equations (2b) and (14) that

$$\begin{bmatrix} -\kappa c_\omega\alpha\hat{\omega}^{-1} & (\sigma + \kappa c_\omega\hat{\omega}) \\ -\alpha\hat{\omega}^{-1} & \hat{\omega} \end{bmatrix} \begin{bmatrix} d\hat{\omega} \\ d\hat{\pi} \end{bmatrix} = \begin{bmatrix} \sigma d\varepsilon^h \\ 0 \end{bmatrix}. \tag{15}$$

Figure 3. *Alternative Model: Backward-Looking Contracts Under Disinflation and Real Wage Dynamics*



The long-run effects of a change in the rate of currency devaluation are

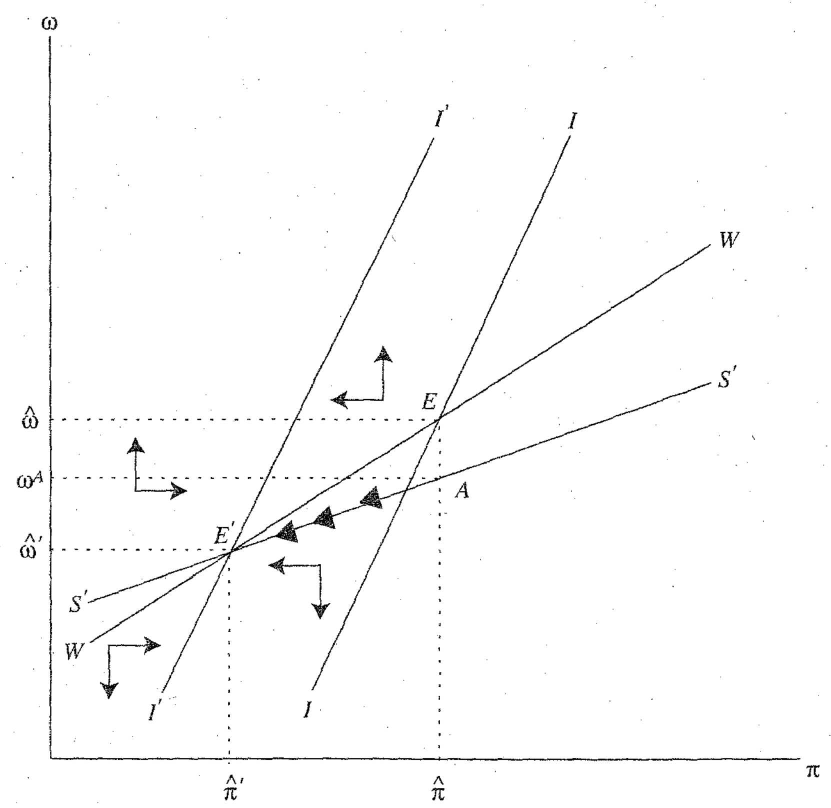
$$\partial\hat{\omega}/\partial\varepsilon^{h} = \hat{\omega}^{2}/\alpha > 0, \text{ and} \tag{16}$$

$$\partial\hat{\pi}/\partial\varepsilon^{h} = 1. \tag{17}$$

In contrast to the backward-looking wage formation scheme, equation (16) indicates that in the long run a fall in the rate of currency devaluation leads to a contraction in the real wage. Equation (17) indicates that the level of the real exchange rate is constant in the new steady state. The results in equations (11), (12), (16), and (17) confirm the Agénor (1996, p. 296) argument: "[r]egardless of the types of wage contract, both the inflation rate and the rate of growth of nominal wages are equal to the devaluation rate ε^{h} in the long run."

Figure 4, which is identical to the lower panel in Agénor's (1996) Figure 5, illustrates how ω and π will behave following a disinflation program in

Figure 4. *Alternative Model: Forward-Looking Contracts Under Disinflation and Real Wage Dynamics*



the context of forward-looking contracts. Under forward-looking contracts, it is clear from equation (14) with $\dot{\pi} = 0$ and equation (2b) with $\dot{\omega} = 0$ that the slopes of *II* and *WW* now become

$$\partial\omega/\partial\pi|_{II} = (\sigma + \kappa c_{\omega}\hat{\omega})/\kappa c_{\omega}\alpha\hat{\omega}^{-1} > 0, \text{ and} \tag{18}$$

$$\partial\omega/\partial\pi|_{WW} = \hat{\omega}^{2}/\alpha > 0. \tag{19}$$

As is evident, the *II* locus is steeper than the *WW* locus.

Upon the shock of a reduction in the rate of currency devaluation from ε^h to ε^s, the *II* locus will shift leftward to *I′I′* while *WW* will remain intact. The new stationary equilibrium thus moves to point *E′*, where *I′I′* intersects *WW*. At the new steady state, the real wage will fall from $\hat{\omega}$ to $\hat{\omega}'$, and the inflation rate will decline from $\hat{\pi}$ to $\hat{\pi}'$. As indicated by the direction of the arrows in Figure 4, a unique trajectory leads the economy to stationary equilibrium *E′*. This trajectory is called the saddle path *S′S′*.

With forward-looking contracts, the nominal wage is free to adjust, as agents will discount the future path of prices when they sign contracts. Therefore, at the moment of lowering the devaluation rate, the real wage ω becomes a jump variable and decreases instantly from $\hat{\omega}$ to $\hat{\omega}^A$. The economy thus will move vertically from point E to A on the saddle path $S'S'$. Thereafter, as the arrows indicate, both ω and π continue to decline as the economy moves along the $S'S'$ locus toward its new stationary equilibrium E'.

III. Concluding Remarks

The Agénor (1996) article definitely contributes to our understanding of the functioning of labor markets in developing countries. In that paper, Agénor sets up a macroeconomic model embodying both backward- and forward-looking contracts, and examines how the change in the devaluation rate of domestic currency will govern the transitional adjustment of the inflation rate and the real wage. In this article, we have tried to propose an alternative model with a different setting in price dynamics. Specifically, changes in the inflation rate in our framework depend upon relative *time change*, rather than relative *amount*, between commodity demand and commodity supply. Under such a framework, Agénor's result that both the price level and nominal wages increase equiproportionally with the currency devaluation in the long run is found to remain valid.

Our framework can be extended in at least two ways. One extension is related to the evolution of foreign reserves. Under the regime in which the monetary authority adopts a constant rate of devaluation, foreign reserves may either accumulate or decrease depending on the status of the balance of payments. The change in foreign reserves will affect the money supply of the economy and the total wealth of the public, which, in turn, govern the evolution of the relevant macroeconomic variables when the linkage between markets is established. Another interesting extension is the introduction of asset markets to allow for the mobility of international capital. Once this is taken into account, we can highlight the role that the degree of capital mobility plays in disinflation programs. However, although these extensions may be of interest in their own right, they are unlikely to alter the basic message of Agénor's model, which is corroborated by our own alternative approach: the nature of nominal wage contracts matters in important ways for the dynamics of stabilization programs, and adoption of a forward-looking contract scheme may help to reduce substantially the cost of disinflation.

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