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INFLATION, EXCHANGE RATES,
AND STABILIZATION

RUDIGER DORNBUSCH



INTERNATIONAL FINANCE SECTION

DEPARTMENT OF ECONOMICS
PRINCETON UNIVERSITY
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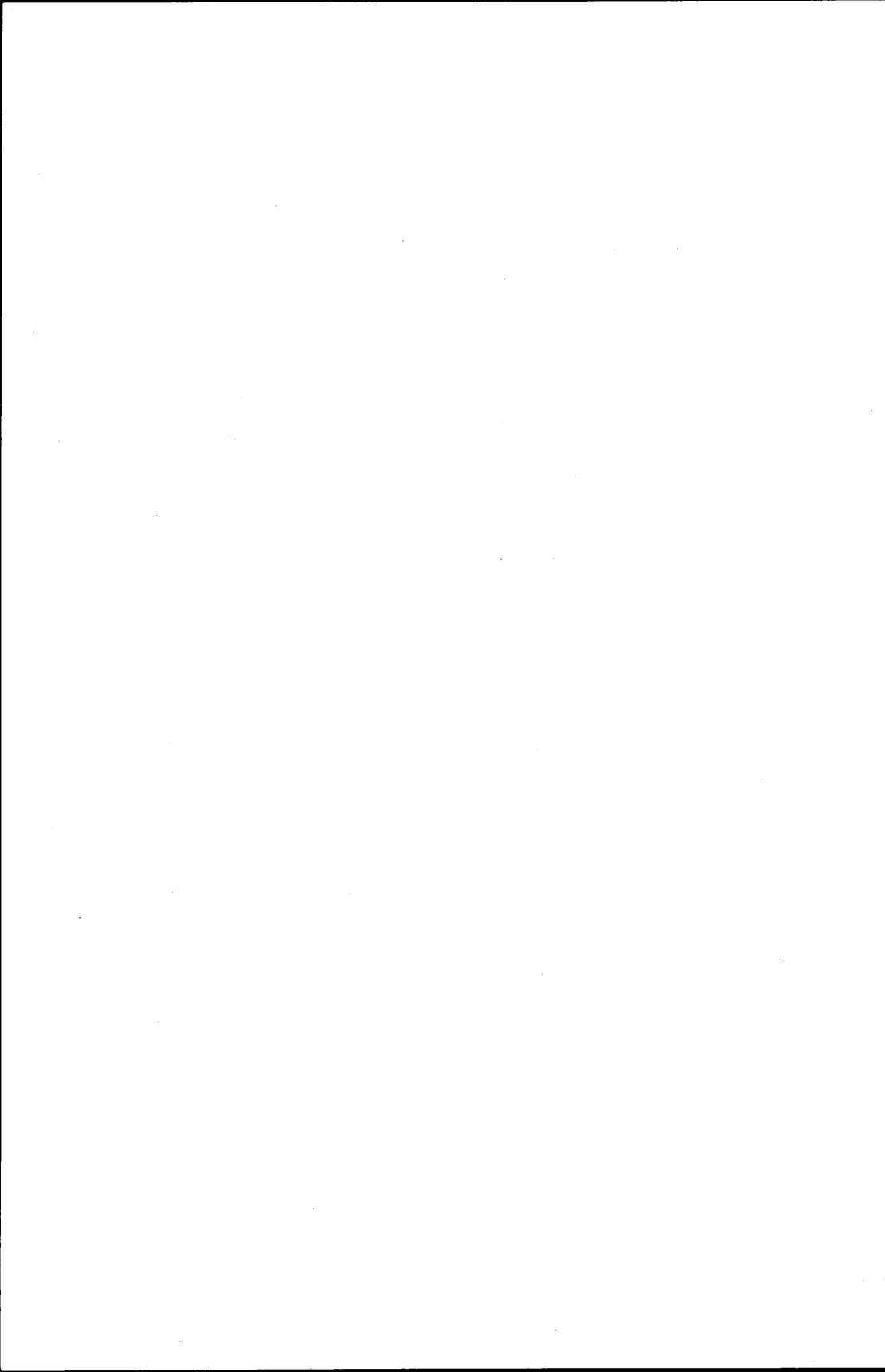
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INFLATION, EXCHANGE RATES, AND STABILIZATION

Frank Graham's interest in the relationship between the monetary standard, exchange rates, and prices spanned his entire professional career. From his 1920 Harvard dissertation on "International Trade under Depreciated Paper" to "Cause and Cure of the Dollar Shortage" in 1949, his work continually touched on the implications of alternative monetary arrangements and the interpretation of actual developments. His most outstanding writing in this area is no doubt *Exchange Rates, Prices and Production in Hyperinflation Germany*, a book that is required reading for anyone who wants to understand the characteristics of extreme monetary experience. International monetary issues were only one of Graham's interests: his work on protection and on general equilibrium can claim as much importance. But his favorite must have been the issue of exchange rates and prices, to which he returned so frequently. It is appropriate to honor his memory with further discussion of this topic.

This essay considers the role that exchange rates play in inflation stabilization. Four different settings are used to examine that role: the experiments with exchange-rate overvaluation in the Southern Cone to which Carlos Diaz Alejandro first drew attention; exchange-rate depreciation in the transition from high to even higher inflation illustrated by the Brazilian experience; exchange-rate fixing and the resulting real appreciation during inflation stabilization in the 1920s; and, finally, the real appreciation of the U.S. dollar from 1980 to 1985. The common thread of the argument is that exchange-rate policy can make an important contribution to stabilization but that it can also be misused and will then lead to persistent deviations from purchasing-power parity (PPP), with devastatingly adverse effects.

The four applications are chosen to highlight quite different issues. In section 1, dealing with Latin America, I direct attention to the trade and capital-account effects of exchange-rate overvaluation. Even though exchange-rate policy can help stop inflation, at least for a while, the resulting overvaluation can become very costly as capital flight and import spending soar in anticipation of the program's collapse. In section 2, I consider the synchronization of wages, prices, and the exchange rate in two contexts. First, I discuss the problem of budget and trade correction in an economy with wage indexation and PPP-based currency depreciation. I then examine attempts to stop hyperinflation by fixing the exchange rate, which is another application of the same set of ideas and is illustrated by the German and Argentine cases. Finally, in section 3, dealing with the U.S. disinflation, I look at the impact of the exchange rate on the prices of commodities and manufactures, analyzing the microeconomic channels through which exchange-rate movements af-

fect relative prices and the inflation process. The essay concludes with quantitative estimates of the contribution of dollar appreciation to U. S. disinflation and the likely inflation cost that must be borne as the dollar comes down again.

1 The Latin American Experiments

In order to bring down inflation in the late 1970s, the authorities in Chile and Argentina used fixed exchange rates or a deliberate reduction in the rate of depreciation relative to the prevailing inflation rate. In Chile's case, the exchange rate was fixed outright even though the prevailing inflation rate was still 30 percent. In Argentina's case, a timetable for pre-fixed disinflation—the *tablita*—was adopted. In both countries, inflation was indeed brought down, but at the cost of destructive overvaluation. The experiments were encouraged by the belief that inflation is in part the result of a vicious cycle: inflation requires depreciation for external balance, but depreciation causes cost inflation both directly and indirectly (via increases in wages), and therefore requires renewed depreciation, and so on. The only means to escape from the inflation trap is to cut the recurrent feedback of currency depreciation.¹

Chile

In March 1979, having achieved a balanced budget, the Pinochet regime in Chile decided to round out its classical stabilization program by putting the country on a fixed dollar exchange rate. Even though the inflation rate was still 30 percent, the peso was pegged at 39 to the dollar forever after, or so the government announced.

Exchange-rate pegging was thought to help bring inflation under control through at least two channels. First, international prices would exert an immediate tight discipline on domestic price increases, perhaps not by the literal operation of the law of one price, but still in a very effective manner. This would be all the more true because extensive trade liberalization had been under way, clearing the road for international competition to play its role. Second, exchange-rate pegging would contribute to inflation stabilization by affecting expectations, particularly in sectors that are price setters rather than price takers. The recognition that the exchange rate would be fixed forever would shift expectations from an inflationary setting to a new regime of price stability.

The disinflation strategy was almost successful: inflation fell from 30 percent to zero over the next two years. But the disequilibria that accumulated

¹ On these Southern Cone experiments, see Corbo and de Melo (forthcoming), Diaz Alejandro (1981), Dornbusch (1985a), Edwards (1985), and Harberger (1983, 1985).

in the process undermined the experiment completely. The standard of living in Chile today is below even the 1970 level, mostly as a result of policy blunders. The problem arose from the fact that wages were indexed *backward*: each year's wage increases were determined by the preceding year's consumer-price inflation. This real-wage policy was one of the tools the military dictatorship used to sustain its support, since it led to a rising real wage. Wage increases exceeded the current inflation rate, which was being held down by the fixed exchange rate in 1978-80. As a result, the purchasing power of wages increased sharply in terms of traded goods, causing a loss of competitiveness and a deterioration of the trade balance. The gain in real wages was all the more significant in that complete trade liberalization had contributed to reducing import-price inflation.

The mechanics of overvaluation can be described in a model of cost-determined price inflation. Let p , w , and e be the rates of consumer-price inflation, wage inflation, and exchange depreciation. For simplicity I assume zero productivity growth. The world inflation rate (in dollars) is given and is denoted by p^* . The consumer-price inflation rate is a weighted average of wage inflation and international inflation measured in pesos:

$$p_t = aw_t + (1-a)(e_t + p^*), \quad (1)$$

where a is the share of labor in total costs. Next I use the indexing rule $w_t = p_{t-1}$ and the exchange-rate rule $e_t = 0$ to rewrite equation (1):

$$p_t = ap_{t-1} + (1-a)p^*. \quad (2)$$

Equation (2) shows that the wage and exchange-rate policies combine to yield a gradually declining inflation rate that ultimately converges on the world inflation rate, p^* . The smaller the weight of wages and the larger the weight of international prices in determining the home inflation rate, the more rapid is the convergence. Equation (2) thus bears out the view that exchange-rate policy can be used for disinflation and that the openness of the economy speeds up and reinforces this disinflation strategy.

The problem with the strategy is brought out by equation (3), which shows the rate of growth of the real wage, $w_t - p_t$:

$$w_t - p_t = p_{t-1} - p_t = (1-a)(p_{t-1} - p^*). \quad (3)$$

The real wage rises for as long as lagged inflation exceeds the international inflation rate. Home inflation gradually comes down (without overshooting), but the real wage steadily increases with no correction at any stage for the cumulative overvaluation. Thus, even as the war on inflation is being won, a se-

rious overvaluation problem is developing. The trade balance deteriorates, and the loss in competitiveness also exerts an increasingly adverse effect on employment and profitability. This model of the inflation process is, of course, highly simplified and leaves out potentially important channels (in particular, demand). Even so, it captures the basic contradiction contained in the wage and exchange-rate policies.²

The disequilibrium implied by fixing too many variables did become a problem in Chile. The real exchange rate appreciated by more than 70 per cent from the third quarter of 1979 to the second quarter of 1982. In every such instance of gross overvaluation, there will always be an attempt to rationalize the overvaluation, commonsense notwithstanding, as a change in *equilibrium* relative prices. In the Chilean case, three arguments were advanced: (1) that trade liberalization and extremely high productivity growth had changed the equilibrium price structure; (2) that the basket of Chilean tradables was very special compared with the basket represented by world inflation; and (3) that the real appreciation was merely a response of equilibrium relative prices to a sharp increase in the rate of capital inflow.

The tendency to rationalize overvaluation may stem from the fact that overvaluation is very popular, at least in the initial stages. Diaz Alejandro (1963) and Krugman and Taylor (1978) have emphasized that devaluation can be deflationary, because it cuts the purchasing power of wages in terms of tradables. The same effect is at work in the opposite direction in periods of increasing overvaluation. The first impact is to raise the purchasing power of wages and thus create a period of prosperity, usually called "the miracle." The miracle can last only as long as the central bank can afford to put foreign exchange on sale. But the income effect of higher real wages comes to be dominated by classical substitution away from overpriced domestic labor, and this may happen even before the central bank's reserves are depleted.

Substitution effects on the demand and supply sides lead to bankruptcy and unemployment, which is always the second stage of an overvaluation experiment. The third stage involves paying the bill: the central bank no longer has reserves, but external debt has been incurred to finance the overvaluation and now needs to be serviced. This calls for a trade surplus generated by austerity and sharp real depreciation. The excessive standard of living of the initial stage is now paid for by a long period of deprivation. The predicament is often aggravated by a differential impact of the policy on rich and poor, because they are not equally able to take advantage of the overvaluation. Workers will almost always pay in the end by a cut in their real wage. The cut is

² The contradiction is worth highlighting, since Chicago graduate students, including the Chilean policy makers, had been brought up on Harberger's classic "The Case of the Three Numeraires," which made the basic point that separate exchange-rate and wage targets are incompatible. See, too, Mundell (1968, Chap. 8) and Swan (1960).

necessary to generate the gain in competitiveness required to service the foreign debt. But workers may not have benefited fully in the first stage, when shifting into foreign assets or purchasing imported durables was the name of the game.

The adverse substitution effects are reinforced by real-interest-rate effects. The expectation of depreciation raises nominal interest rates on peso loans. But because the government does not in fact allow the currency to depreciate, real interest rates remain high, imposing financial difficulties on all those firms which are already unprofitable and whose debts are growing relative to assets and earning potential.

In Chile, the overvaluation played itself out through the trade balance. The combined effects of overvaluation and trade liberalization cheapened imports in real terms to an unprecedented extent. There was thus growing doubt that the overvaluation was sustainable, and the public came to believe that access to cheap imports would ultimately disappear via devaluation, tariffs, or quotas. As a result, the level of imports exploded in 1980-81. This was particularly the case for durables; automobile imports doubled, imports of consumer appliances increased nearly 60 percent, and imports of breeding stock more than tripled.

Needless to say, devaluation did take place in the end, inflation is back to above 20 percent, tariffs and quotas are back, the budget has deteriorated, the debt crisis is on, and unemployment has been at record levels for a few years. The exchange-rate experiment has proved to be a terrible mistake, because the effects of wage indexation were ignored. The mistake was compounded by the arrogant stupidity of policy makers, who watched growing overvaluation without recognizing the fatal flaw early on or preparing for the inevitable collapse.

Argentina

The attempt to stabilize the Argentine economy by means of the *tablita* was initiated by Economics Minister Martinez de Hoz in December 1978. Because the inflation rate stood at 120 percent, an outright fixing of the exchange rate seemed implausible. Instead, the government committed itself to a preset declining rate of currency depreciation. The exchange-rate timetable was seen as an important instrument for stabilizing expectations in line with a declining inflation trend.

As in Chile, however, domestic inflation did not decline as rapidly as the rate of depreciation, and the reasons are still debated. The heavily protected Argentine economy and the persistently large budget deficit must certainly be important elements of any explanation. A huge real appreciation took place between 1978 and 1980 and undermined the attempt at disinflation. The inflation rate fell from 120 percent in 1978 to only 60 percent in early

1981. But the system of pre-fixed exchange rates broke down in early 1981, leading to a rapid escalation of inflation that ultimately reached hyperinflation in 1985.

The important difference between the Chilean and the Argentine cases is the channel through which exchange speculation took place. In Chile, trade had been completely liberalized, so flight into importables was the rule. In Argentina, the capital account had been completely opened, so flight into foreign assets was the rule.

Estimates of the magnitude of capital flight are available from a variety of sources. They can be built up from balance-of-payments statistics and increases in gross external debt or from recorded asset holdings. Table 1 shows estimates of the capital flight from three countries from 1979 to 1982 and the increase in their nationals' holdings of deposits or securities with U.S. banks.

Estimates of the amount of capital flight from Argentina from 1978 to 1982 vary, but \$20-\$25 billion is certainly conservative (see *World Development Report*, 1985, pp. 63-65, and Dornbusch, 1985a). Argentine residents, fully aware that the overvaluation of the real exchange rate ultimately had to come to an end, fled into dollar assets, U.S. currency, and real estate in Brazil or Uruguay. The capital flight was financed by the central bank's borrowing from abroad; the proceeds were used to sustain the *tablita* against domestic speculation.

The Chilean and Argentine cases teach the same lesson. If rates of depreciation are to be set below the prevailing inflation rate for some period in order to achieve disinflation, at least three conditions are necessary for success: (1) the monetary and fiscal fundamentals must be consistent with the exchange-rate target; (2) a maximum effort must be made to pursue an incomes policy consistent with the exchange-rate policy rather than rely passively on economic slack and expectations to influence the inflation rate; (3) the government must actively block losses of reserves occasioned by speculation in

TABLE 1
CAPITAL FLIGHT AND INCREASES IN HOLDINGS
WITH U. S. BANKS, 1979-82
(in billion of U. S. dollars)

	Total Capital Flight	Increased Holdings with U. S. Banks
Argentina	19.2	1.9
Mexico	26.5	5.3
Venezuela	22.0	4.6

SOURCE: *World Development Report*, 1985, p. 64,
and *Treasury Bulletin*, various issues.

durables or foreign assets. Transitory taxes on durables can prevent the sort of speculation that occurred in Chile under an open trading system; complete capital mobility should certainly not have been a feature of the Argentine stabilization plan. There is not much of a case to be made for free capital outflows from a developing country at the best of times. During stabilization, it definitely is not a priority.

Other Experiences

I have singled out the experiences of Chile and Argentina because they are particularly clear-cut. But there were other instances of this policy approach in the 1978-83 period. By allowing the peso to become overvalued in 1980-82, Mexico provoked massive imports and capital flight, as shown in Table 1. Venezuela, Peru, and Israel pursued overvaluation policies until they collapsed. In every case, the exchange rate was fixed in order to decelerate inflation and reap political benefits. Without exception, the policy *ultimately* imposed fantastic costs because of the large increases in foreign indebtedness and the massive devaluations that were finally required.

2 Exchange Rates and High Inflation

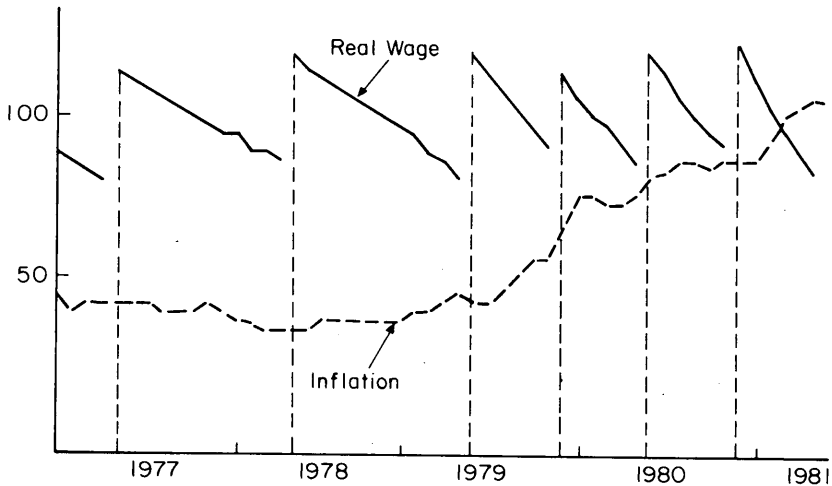
In this section, dealing with the role of exchange rates in episodes of extremely high inflation, I make two points. First, in a context of institutional wage setting, accelerating inflation ultimately leads to a shift from backward-looking pricing decisions to exchange-rate-based pricing. Second, in the stabilization of extreme inflation, fixing the exchange rate may be a strategic measure that establishes immediate support for a drastic program.

The Simonsen-Pazos Mechanism

Institutional wage-setting mechanisms often rely on a contract, with wage adjustments at specified intervals over the fixed life of the contract. Each adjustment will be based on the accumulated increase in prices since the last adjustment. A good example is the Brazilian wage mechanism: wage earners received full compensation for past actual price increases at regular intervals—yearly until 1980, and at six-month intervals thereafter, until 1986. The question of what happens when the frequency of adjustment increases has been considered by Simonsen (1983) and Pazos (1972). The point is of interest here because it highlights the characteristics of an accelerating inflation and the role of exchange-rate depreciation in that context.

With periodic wage adjustments, the real wage follows the sawtooth pattern shown in Figure 1. On each adjustment date, the real wage is increased to offset the decline caused by inflation since the preceding adjustment, say 50 percent. It declines again over the next interval as the ongoing inflation

FIGURE 1
 THE REAL MINIMUM WAGE AND INFLATION IN BRAZIL
 (1977-78 = 100 for wages; inflation in % per annum)



erodes the purchasing power of the constant nominal wage payment. By the end of the interval, the real wage has declined below its period average. The higher the inflation rate, moreover, the lower the average real wage, given the length of the adjustment interval.

In a system of full but lagged indexation, the real wage can be cut only by moving to a higher inflation rate. A once-and-for-all depreciation of the currency immediately raises the inflation rate and erodes existing contracts. But the catch-up through indexation inevitably pushes inflation to an even higher rate, so that some group of wage earners is always lagging behind the increasing rate of price rises. The same principle applies to the removal of subsidies to correct the budget. Measures imposed to correct competitiveness or the budget can be effective only if they achieve a cut in the real wage. Because of full indexation, however, the real wage can be cut only by allowing inflation to run at a higher rate. This mechanism often sets the stage for inflation explosions.

Consider a country that requires budget adjustments and an increase in external competitiveness. The government does not have the political force to suspend full indexation, so that the removal of subsidies or depreciation of the currency will speed up the inflation rate. Workers in the middle of their contracts or three-quarters of the way toward the next adjustment will find that their real wages fall below what they consider a minimum standard of living. Since they cannot borrow, even in perfect capital markets, they will demand

a shorter interval between wage adjustments in order to recover the real wage losses imposed by inflation. They will ask for an advance of what they think is due. If the economy shifts from, say, six-month to three-month indexation intervals, the inflation rate will simply double (see Simonsen, 1983). But once wage setting has moved to a three-month scheme, two facts are clear: (1) It is extremely unlikely that indexation will return spontaneously to a longer interval, even if shocks are favorable. (2) There is nothing to make the three-month interval more stable than the six-month interval that was just abandoned. Renewed shocks will shift the economy to even more frequent adjustments and hence to correspondingly higher inflation rates. This is the stage at which the exchange rate becomes critical.

In his seminal study of inflation in Latin America, Pazos (1972, pp. 92-93) describes the dynamics as follows:

When the inflation rate approaches the limit of tolerance, a growing number of trade unions ask for raises before their contracts become due. And management grants them. These wage increases give an additional push to inflation and bring about a further reduction of the adjustment interval. Probably the interval is initially shortened to six months, and then, successively, to three months, one month, one week, and one day. At first the readjustment is based on the cost-of-living index; but since there is a delay of one or two months or more in the publication of this index, it must soon be replaced by another. The best-known and more up-to-date of the possible indicators in Latin America is the quotation of a foreign currency, generally the U.S. dollar.

This description makes clear that the dramatic escalation of inflation, seemingly disproportionate to the disturbance, arises from the endogeneity of the adjustment interval. Changes in that interval are due not so much to the direct impact on inflation of corrective exchange-rate or price policies as to minor but highly visible increases in inflation, such as a 10 percent devaluation over and above a PPP rule or the removal of bread subsidies. These straws break the camel's back, leading to an increase in the frequency of wage adjustments and a much higher inflation rate. The endogeneity of the adjustment interval is the mechanism that connects a small inflationary disturbance with a large shift in the inflation rate, such as the shift from 50 to 100 percent inflation in Brazil in 1980.

Figure 1 shows the real wage in Brazil from 1977 to 1981, as well as the inflation rate over the previous twelve months. Readjustments occurred annually in May until 1979. In November 1979, the new Minister of Planning, Antonio Delfim Neto Filho, halved the indexation interval and devalued the currency. With little delay there ensued a very rapid increase in the inflation rate to well over 100 percent.

The exact sequence of events that leads to more frequent indexation will differ: the government may cave in under the impact of a strike, business may

find it is easier to give an "advance" on the real wage adjustment than to risk labor unrest in the middle of a recovery or boom, or a planning minister may seek the popularity that comes from a wage policy apparently favoring labor. One way or another, the frequency will increase, and once it happens in a large part of the economy it cannot fail to become generalized.³

It is immediately clear from the Simonsen-Pazos analysis that the optimal incomes policy in this context is one that monitors the frequency of adjustments above all. An entirely different view emerges with respect to exchange-rate and budget policy. As long as there is full indexation, even seemingly small corrections are a dramatic threat to the stability of the inflation rate and hence may not be worth undertaking.

Stopping Hyperinflation

Once frequencies have been shortened to a weekly or daily interval, hyperinflation conditions exist such as those experienced in Central Europe in the 1920s and again in the immediate post-World War II period, and more recently in Argentina, Bolivia, and Israel. Now the exchange rate comes to play an important role in stabilization.

The case of Germany is perhaps the clearest. In the final month of the hyperinflation, October-November 1923, the inflation rate reached 30,000 percent per month. Prices were adjusted more than once a day to the official exchange rate, which was also changing more than once a day. As hyperinflation developed, the dollar quotation moved from the financial pages to the front page. It became the central front-page feature for the same synchronization reasons that the *New York Times* displays the shift from daylight-saving to standard time.

If everyone watches the exchange rate as the signal for setting wages and prices, it becomes natural to exploit that signal to end the inflation. Fixing the exchange rate outright, at 4.2 trillion Reichsmark or 0.8 australes per dollar, becomes a critical first move in bringing inflation to a screeching halt. Of course, exchange-rate fixing cannot substitute for budget correction. But even with the budget corrected, it may be a needless gamble on the perfect functioning of markets to rely exclusively on the credibility of the commitment to keep the budget corrected. This is all the more true in that no policy is truly exogenous: budget correction works if it successfully stems inflation without exceptional cost. If a lack of credibility raises the cost of a disinflationary policy, the attempt may go under even if it could have survived with more favorable expectations.

The use of exchange-rate fixing and wage-price controls is therefore a help-

³ Note that the dynamics of the transition between intervals have not been modeled. Schelling's (1978, Chap. 3) analysis of group choices, placed in a macroeconomic setting, might be a start.