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The Inflationary Impact of Repetitive Devaluation

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It is suggested that in countries which have sustained a significant inflationary condition and, as a consequence, have frequently changed their foreign-exchange rate, price expectations may be developed on the basis of these changes. In order to examine this hypothesis a macroeconomic model is built and econometric tests are undertaken using quarterly data for Brazil, Chile, and Uruguay. The author warns that since repetitive devaluation-type policies can fuel price expectations, they may only lead to increased domestic inflationary pressures, balance of trade deficits, and further rounds of devaluation

Ever since mid-1971, when the rules of the Bretton Woods system were abandoned, the world has witnessed considerable fluctuations in the rates of foreign exchange. Economists have begun focusing much attention on this unusual experience, and many research efforts are currently being devoted to an evaluation of the present international monetary condition. Three main kinds of studies are being undertaken. First, some researchers are describing the institutional and economic factors that determined the collapse of order in the world financial network, and are suggesting ways to prevent further decay in international monetary relations Among these are many economists whose efforts are aimed at proposing new world financial arrangements. Second, some economists are predicting and/or measuring the effect of the parity changes on the value and direction of countries' international trade and capital flows. Finally, others are attempting to analyze the consequence of the devaluations and revaluations on the domestic economies of the countries involved

The purpose of this paper is to provide and test a hypothesis concerning the effect of frequent exchange-rate changes on the economies of three developing countries. Specifically, the price-level effects of relative exchange rate flexibility are analyzed. The proposition is advanced that, in countries where important economic relationships are influenced by people's expectations about the rate of inflation, changes in the price of foreign exchange can easily become an important contributor to domestic price instability.

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It is well known that a change in the foreign exchange rate is likely to have an immediate effect on the price of tradable goods [see *Porzecanski, 1972*]. Unless countered by a simultaneous relaxation of trade controls a devaluation, for example, will increase the domestic price of import goods and, in the short-run, will also increase the price of exportables. The magnitude of these once-and-for-all price-level effects depends on the elasticity of foreign demand for export goods, the domestic demand elasticity for importables, the extent of full-resource utilization, the degree of domestic competition, and the existence of import controls and export taxes If, as is usually assumed, the exchange rate is changed so as to influence the direction of trade flows, then these price-level effects are expected and deemed desirable. But there are instances in which an exchange-rate change can exercise a more dynamic and long-run effect on the level of prices. If as a result of, say, a devaluation, workers feel that a rise in the consumer price index has significantly affected their purchasing power, higher wages may be demanded and cost-push pressures may quickly develop This is more certain to be the case when workers are protected by cost-of-living clauses aimed at guaranteeing them a real wage. Also, if the country in question has a capital goods or consumer durables industry which imports its raw materials, fuels, and parts, businessmen are likely to pass increased costs along to other businessmen and consumers, generating a society-wide purchasing power reduction that invites further cost-push pressures.

At this point the reader's attention should be drawn to the fact that recently several economists have pointed out that the rate of inflation in the long run is very much determined by the rate of price increases people anticipate.[1] In fact, those 'price expectations' are fed by actual inflation, and lead such important functions as the demand for and supply of labour and capital, consumption, investment, and the demand for money to be affected by inflationary expectations. Those expectational variables twist these macroeconomic relationships in a manner such that further price increases are assured. It would be interesting to discover the elements that constitute the base upon which 'inflationary psychology' is built, since increasing academic debate is centred on the way in which price-rise anticipations can best be minimized or at least brought under control.

In the analysis of exchange-rate changes there is, hence, one more transmission mechanism which has not received attention in the literature. I am referring to the possibility that, given frequent parity adjustments, the price of foreign exchange can become one of the components of price expectations There are two reasons for this. First, because exchange-rate changes can be considered a predictor of impending price-level changes. And second, because the exchange rate can be taken as an indicator of purchasing power. Certainly, the use of the exchange rate as a basis for inflationary expectations depends on the importance of foreign trade to the particular country, the relative flexibility of exchange rates, and on the many structural parameters mentioned above. But economists must not be misled: inflationary expectations and whatever they are based on are relatively subjective phenomena, and adequate 'objective' criteria may be hard to formulate. The psychological influence of any economic variable can be much greater than supposedly warranted. Besides, the exchange rate is a very handy indicator Unlike government cost-of-living statistics, which may be suspect because of possible government tampering, 'untypical' market basket, or delays in its publication, the exchange rate (whether it is the official or a more freely fluctuating black-market rate) may be viewed as an instant, accessible, and uncorrupt indicator Furthermore, in countries which have experienced an extended inflationary condition and have, therefore, devalued often the velocity with which key economic-behavioural functions adjust themselves to price-level movements is very much increased. Indeed, in the context of continued inflation and repetitive devaluation, a majority of the people are pushed into an aggressive market interplay where the preservation of one's purchasing power becomes a *sine qua non* The necessity for an almost 'instantaneous' purchasing-power indicator and inflation predictor can now be better understood, as can the choice of the exchange rate as a key gauge in the midst of a struggle for economic survival

THE PRICE EXPECTATIONS MODEL

On the basis of the above discussion I have constructed, keeping in mind the data limitations, a relatively simple macroeconomic model Real aggregate demand (YD) is defined as the addition of real consumption (C), real investment (I), real government purchases (G), and the trade balance (X–M) Consumption is an increasing function of aggregate demand and of price expectations (P*), while investment is a decreasing function of the real interest rate (r) Exports are an increasing function of last period's exchange rate (R_{t-1}), and imports are a decreasing function of last period's exchange rate and an increasing function of aggregate demand—where R is defined as the price of foreign exchange The demand for money (MD) is positively related to aggregate demand and inversely related to both the rate of interest and price expectations. The money and commodity markets are in equilibrium, with the supply of and demand for money equal to one another (MS=MD) and aggregate demand and supply also equal (YS=YD) Also, short-run aggregate supply is an increasing function of the price level (P) and a decreasing function of price expectations. Finally, price expectations are assumed to be a function of last period's price level (P_{t-1}) and of last period's price of foreign exchange. This is the model·

(1) $YD=C+I+G+X-M$

(2) $C=a+bYD+cP^*$

(3) $I=d-er$

(4) $X=f+gR_{t-1}$

(5) $M=h-iR_{t-1}+jYD$

(6) $MD=q+sYD-tr-uP^*$

(7) $MD=MS$

(8) $YD=YS$

(9) $YS=vP-wP^*$

(10) $P^* = k + mP_{t-1} + nR_{t-1}$

The model's ten endogenous variables are YD, YS, C, I, X, M, MD, P^*, r, and P; the four exogenous variables are G, MS, R_{t-1}, and P_{t-1} As can be observed, it is stated that price expectations affect consumption, the demand for money, and aggregate supply. This is because when consumers anticipate a rise in prices they will hedge by spending more now instead of later, similarly, cash holders will demand less money when they expect price increases; finally, while higher product prices will induce producers to expand output, the anticipation of accelerated inflation will trigger demands for higher wages and, because of factor-cost increases, will have a negative effect on production. For simplicity, hold exchange rates to affect exports, imports, and price expectations with an identical lag (t-1)

First we solve for the interest rate in the commodity and money markets. Setting

$a' = a + ck + d + f - h$, $c' = cn + g + i$; and $m' = cm$,

we obtain that

$r = a'/e + (m'/e)P_{t-1} + (c'/e)R_{t-1} + G/e - YD(1-b+j)/e$

Similarly, setting

$a'' = a'/e$; $m'' = m'/e$; $c'' = c'/e$; $e' = 1/e$; and $b' = (1-b+j)/e$

we then have

$r = a'' + m''P_{t-1} + c''R_{t-1} + e'G - b'YD$

In the money market

$r = q/t + (s/t)YD - (uk)/t - (um/t)P_{t-1} - (un/t)R_{t-1} - MS/t$

Setting

$q' = q/t - uk/t$, $s' = s/t$, $m''' = mu/t$, $n' = nu/t$, and $t' = 1/t$

we then obtain

$r = q' + s'YD - m'''P_{t-1} - n'R_{t-1} - t'MS$

Setting the interest rates equal to one another and doing the following substitutions we get:

$\alpha_1 = a''/b' + s' - q'/b' + s'$, $\alpha_2 = (m'' + m''')/b' + s'$, $\alpha_3 = (c'' + n')/b' + s'$, $\alpha_4 = t'/b' + s'$; and $\alpha_5 = e'/b' + s'$

Then, $YD = \alpha_1 + \alpha_2 P_{t-1} + \alpha_3 R_{t-1} + \alpha_4 MS + \alpha_5 G$

Now we set YD=YS and solve for the price level, but we first perform the following substitutions.

$\beta_1 = (\alpha_1 + wk)/v$; $\beta_2 = (\alpha_2 + wm)/v$; $\beta_3 = (\alpha_3 + wn)/v$; $\beta_4 = \alpha_4/v$; and $\beta_5 = \alpha_5/v$

Then,

$$P = \beta_1 + \beta_2 P_{t-1} + \beta_3 R_{t-1} + \beta_4 MS + \beta_5 G \quad (1)$$

It would be interesting to test for the changes in the value of the parameters over time. Assuming the existence of a speed-of-adjustment coefficient σ, Equation 1 is modified in the following manner:

$$\Delta P = \sigma[P - P_{t-1}]$$

$$P - P_{t-1} = \sigma[\beta_1 + \beta_2 P_{t-1} + \beta_3 R_{t-1} + \beta_4 MS + \beta_5 G] - \sigma P_{t-1}$$

$$P = \sigma\beta_1 + \sigma\beta_2 P_{t-1} + \sigma\beta_3 R_{t-1} + \sigma\beta_4 MS + \sigma\beta_5 G + (1-\sigma)P_{t-1}$$

$$\Delta P = [\sigma\beta_2 + (1-\sigma)]\,\Delta P_{t-1} + \sigma\beta_3\,\Delta R_{t-1} + \sigma\beta_4\,\Delta MS + \sigma\beta_5\,\Delta G \quad (2)$$

TABLE 1

CONSUMER PRICE INDEX AND EXCHANGE-RATE CHANGES FOR THREE LATIN AMERICAN COUNTRIES

Year	Brazil		Chile		Uruguay	
	%ΔPc	%ΔRf	%ΔPc	%ΔRo	%ΔPc	%ΔRf
1957/58	16	87				
1958/59	37	13				
1959/60	35	18				
1960/61	38	49				
1961/62	53	41			11	1
1962/63	75	44			21	34
1963/64	85	159			43	41
1964/65			29	28	56	138
1965/66			23	28	73	37
1966/67			18	27	89	61
1967/68			27	37	125	112
1968/69			31	31	21	8
1969/70			32	27	16	3
1970/71					24	75

NOTE figures are rounded; Δ stands for change, Pc for consumer price index, and Ro and Rf for official and free exchange rate, respectively

SOURCE *International Financial Statistics,* see below, footnote 2 Data shown are for the years which were studied, and generally correspond to those during which inflation was most acute

It is equations 1 and 2 that we want to test, then, in our econometric analysis.

ECONOMETRIC TESTING

Brazil, Chile, and Uruguay were chosen as the subjects of our econometric analysis. The reasons for this were all countries had a relatively recent experience of extended inflation at an accelerating or relatively high rate (see Table 1), all three had a rich experience of repetitive and significant exchange-rate changes (mostly devaluations, see Table 1), all had an important foreign trade sector, in which the value of yearly exports plus imports accounted for over 15 and up to 30 per cent of their gross national product; data for the parameters were available, although no prolongated time period during which prices or exchange rates were frozen at a given level was included in the sample. Quarterly data were used because during an important inflationary experience yearly data probably do not accurately picture the more rapid economic adjustments taking place Unfortunately, given that government purchases data for these countries are unavailable on a quarterly basis, the terms $\beta_5 G$ and $\sigma\beta_5 \Delta G$ had to be dropped from equations 1 and 2, respectively. However, a time trend was added to equation 1, namely, δT. The samples chosen were the following. Brazil, 27 quarterly observations (1957–63), Chile, 20 quarterly observations (1965–70); and Uruguay, 28 quarterly observations (1963–70). For Brazil the 'free' exchange rate was chosen because it did fluctuate quite freely; for Chile the official ('trade') rate was chosen for the same reason; and for Uruguay both the official and the more free 'financial' rates were tried.[2]

As can be observed from Tables 2 and 3, our econometric analysis shows

TABLE 2

RESULTS OF REGRESSION ANALYSIS FOR EQUATION 1

$Pc = \beta_1 + \beta_2 P_{t-1} + \beta_3 R_{t-1} + \beta_4 MS_{t-1} + \delta T$

β_1	β_2	β_3	β_4	δ	F	$\bar{R}_2$	h
BRAZIL (R=Rf)							
—34 2	+1 1	+ 37	+ 034	—4 3	5166	99	—1 9
(4 3)**	(14·7)**	(2 9)**	(52)	(3 5)**			
CHILE (R=Ro)							
+70 6	— 33	+35 3	+54 6	—3 4	2000	·99	— 6
(5·5)**	(1 5)*	(3 9)**	(7 0)**	(3 3)**			
URUGUAY (R=Ro)							
—37 7	+ 48	+4 4	+ 003	+10 2	839	99	(†)
(8)	(2 4)**	(2 6)**	(74)	(1 7)*			
	(R=Rf)						
—49	+ 58	+3 7	+ 002	+8 5	730	99	(†)
(1 0)	(2 4)**	(1 7)*	(5)	(1 1)			

NOTE figures are rounded figures in parenthesis correspond to the coefficient's T-ratio, F stands for the F statistic, $\bar{R}_2$ stands for the adjusted correlation coefficient squared, h stands for the h statistic which results from the Durbin-h test, * stands for coeffiicent significance at the 10 level, while ** stands for coefficient significance at the 05 level, (†) indicates failure of the Durbin-h test because the estimated sample variance of the coefficient of Pt-1 times the number of observations is greater than one, thus making it impossible to take the square root

TABLE 3

RESULTS OF REGRESSION ANALYSIS FOR EQUATION 2

$\Delta Pc = \delta + [\sigma\beta_2 + (1\text{-}\sigma)]\Delta P_{t-1} + \sigma\beta_3 \Delta R_{t-1} + \sigma\beta_4 \Delta MS_{t-1}$

	$\sigma\beta_2 + (1 - \sigma)$	$\sigma\beta_3$	$\sigma\beta_4$	F	$\bar{R}^2$	h
BRAZIL (R=Rf)						
—3 8	+ 83	+·43	+ 20	76·7	90	—1 5
(54)	(8 3)**	(3 3)**	(2·4)**			
CHILE (R=Ro)						
—3 1	— 13	+21 2	+62·2	18 4	74	*(0)*
(73)	(53)	(1·6)*	(7 0)**			
URUGUAY (R=Ro)						
+19 9	+ 37	+3 6	+ 006	24 7	73	2 8
(1 1)	(2·7)**	(3 4)**	(2·2)**			
	(R=Rf)					
+14 5	+·19	+5·4	+ 009	22 1	71	*(0)*
(·84)	(·94)	(3 0)**	(3 0)**			

NOTE figures and symbols have the same meaning as in Table 2.

that past exchange-rate changes appear to influence the present level of prices through the price-expectations mechanism as derived from our model. In addition, for the cases of Brazil and Uruguay past exchange rates are always a stronger and more significant predictor of present price-level changes than past money-supply changes. Finally, past exchange rates are, in the case of Chile and Uruguay, a greater and more significant predictor of present price-level changes than past price-level changes themselves.[3]

AN EXTENSION

Recall that our aggregate supply equation was of the nature

$$YS = vP - wP^*$$

The reason for P^* having a negative effect on production has already been explained above, namely, businessmen fear inflation because, for instance, wages and other costs of production will be pushed upwards. It would be interesting to see how this postulated relationship fares when confronted with the data. Substituting equation 1 and the expectations relationship into this aggregate supply equation we obtain:

$$YS = v[\beta_1 + \beta_2 P_{t-1} + \beta_3 R_{t-1} + \beta_4 MS + \beta_5 G] - w[k + mP_{t-1} + nR_{t-1}]$$

$$YS = (v\beta_1 - wk) + (v\beta_2 - wm)P_{t-1} + (v\beta_3 - wn)R_{t-1} + v\beta_4 MS + v\beta_5 G \quad (3)$$

Price-level increases have a positive effect ($v\beta^2$) on aggregate income because businessmen increase output if they observe their prices rising. However, inflation is feared by the business community if it signals, through anticipated inflationary expectations, the coming of wage-push pressures. This latter dampening effect on aggregate income is symbolized by $-wm$. As concerns devaluations, they are welcome ($v\beta_3$) because domestic suppliers know they will observe an increase in sales; on the other hand, they are unwanted ($-wn$) if they affect price expectations and, ultimately, the costs of production.

At equilibrium, $YS = YD = Y$. Since a manufacturing output index on a quarterly basis was only available for Chile, equation 3 was tested only for that country.[4] Statistically, the results were not very encouraging (see Table 4). Even when the changes, rather than the levels, of the variables were examined—following the same type of derivation which converted equation 1 into equation 2—$\bar{R}^2$ was quite low, the F test showed significance only at the .05 level, and MS, MS_{t-1}, and MS_{t-2} turned out to be negative. Nevertheless, it is interesting to note that, at least for Chile, price-level changes have affected output positively ($v\beta_2 < wm$), while exchange-rate changes have done so negatively ($v\beta_3 > wn$). This could indicate that the exchange rate's price expectational influence on aggregate supply is considerably stronger that its stimulating, expansionary effect.

TABLE 4

RESULTS OF REGRESSION ANALYSIS FOR CHILE

$$\begin{array}{llllll}
Y = 125\ 7\ + & 81P_{t-1} & -\ 33\ 5R_{t-1} & -\ 7{\cdot}7MS_{t-2} & -\ 48V_{t-1}\ + \\
\quad (4{\cdot}4)^{**} & (2\ 3)^{**} & (3\ 0)^{**} & ({\cdot}51) & (2\ 1)^{**} \\
\quad +2T & & & & \\
\quad (1\ 5) & & & & \\
\quad F = 3\ 3; & \bar{R}^2 = \ 38, & h = (\dagger) & & \\
\Delta Y = -2\ 9\ + & {\cdot}83\Delta P_{t-1} & -19\ 3\Delta R_{t-1} & -\ 11{\cdot}3\Delta MS_{t-2} & -\ 69\Delta Y_{t-1} \\
\quad (\ 79) & (2\ 6)^{**} & (1\ 5)^{*} & ({\cdot}68) & (3\ 2)^{**} \\
\quad F = 5, & R^2 = \ 47, & h = {\cdot}2 & &
\end{array}$$

NOTE figures and symbols have the same meaning as in Table 2.

CONCLUSIONS

This paper has attempted to suggest and provide some evidence as to the possibility that, in countries where domestic inflation has made people purchasing-power conscious, frequent exchange-rate changes can strongly affect price expectations. In other words, although it is known that domestic inflation usually forces countries to devalue, it is hereby shown that repetitive devaluations can also aggravate a country's inflationary condition. Hence, even if the size of a country's relevant price elasticities of demand and supply would indicate that an exchange-rate change ought to improve its trade balance, actual devaluations can affect price expectations and the rate of inflation such that, in the long-run, the balance of trade is not improved after all.

In conclusion, the governments of countries which change their foreign-exchange rate to match domestic price-level increases must bear in mind that those parity adjustments can strongly affect their rate of inflation. In fact, they must be aware that changes in the rate of foreign exchange may not at all succeed in affecting their long-run balance of trade. In this sense, measures which directly attempt to reduce domestic inflationary pressures might be more successful in stimulating their trade-balance performance.

NOTES

1 Among the earliest exponents of this hypothesis is Milton Friedman [*1968*]. However, Phillip Cagan's [*1956*] study of hyperinflation included a discussion of the role of expectations Among the many econometric tests which have been conducted are those of Lucas and Rapping [*1969*], Parkin [*1970*], and Solow [*1969*] For an interesting review of the contributions see the article by Mulvey and Trevithick [*1972*]

2 For Brazil 1957/II-1963/IV data were used, P=cost-of-living with base 1953=100, item † 64 in *International Financial Statistics* (from now on *IFS*), International Monetary Fund, various issues, R=free rate, according to which most exchange transactions were carried out, item † 5, 02, or b in *IFS*, MS=money=reserve money plus demand deposits minus currency iu commerical banks minus banker's deposits, item † 34 in *IFS*, in millions of new cruzeiros For Chile 1965/II-1970/I data were used, P=cost-of-living with base 1963=100, item † 64 in *IFS*,R=trade exchange rate, according to which all trade and trade-connected transactions, government operations, sales of exchange by the large mining companies, and certain invisibles were conducted, item † a in *IFS*, MS=money, item † 34 in *IFS*, in billions of escudos. For Uruguay 1963/II-1970/I data were used, P=consumer price index with base 1961=100, provided by Uruguay's Central Bank and available on request, Ro=official selling rate, item † a in *IFS*, and Rf=the financial rate, item † b in *IFS*, the official rate applied for proceeds from main exports and certain imports, while the financial rate was a freer inter-bank market rate, MS=money, item † 34 in *IFS*, in millions of pesos, MS for 1966/III/IV are butt-spliced, while 1969/I/II was interpolated data, the entire MS series was provided to me by the International Monetary Fund's Bureau of Statistics.

3 Serial correlation is not significantly different from zero, and although multicollinearity among R_{t-1} and MS_{t-1} is considerable, it is much smaller between ΔR_{t-1} and ΔMS_{t-1}.

4 At factor costs, Chile's manufacturing sector contributes about 30 per cent of the net domestic product Y=manufacturing production index, with base 1963=100, item † 66a in *IFS*.

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