REAL EXCHANGE RATE VARIABILITY
AND
MONETARY DISTURBANCES

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WE ARE GRATEFUL TO JOSHUA AIZENMAN FOR HIS SUGGESTIONS.

1. INTRODUCTION

There is now a large body of empirical literature documenting and explaining the substantial short-term deviations of the exchange rates from purchasing power parities (PPP) (see e.g. J. Frenkel (1981), Kravis (1984)). The most widely accepted explanation of this phenomenon relies on models in which prices are sticky in the short run. In such models exchange rates adjust immediately to new information. As a result, they will tend to fluctuate around PPP.

A phenomenon which is less well understood is the substantial difference in the experience of different countries with widely divergent monetary and inflationary environments. The following table illustrates these differences. It shows the mean (absolute) monthly change of the real exchange rates of a sample of countries during 1970-1982(1). It is evident that the short term variability of the real exchange rates has been quite different across countries with some countries experiencing real exchange rate variability which was five times higher than others.

In this paper we contribute towards an explanation of these differences. The focus of this explanation will be put on the differences in monetary regimes across countries. In addition, we will try to isolate some structural factors. In section 2 a theoretical model is developed. Section 3 provides the empirical evidence, and section 4 draws the conclusions.

Table 1 : Mean absolute monthly change of real effective exchange rates,
in percent (1970-1982)

1. Germany	1.92
2. Switzerland	2.11
3. Austria	1.90
4. Netherlands	1.88
5. Canada	0.82
6. Norway	1.56
7. France	1.70
8. Japan	2.00
9. Denmark	1.91
10. United Kingdom	1.77
11. Italy	1.41
12. Spain	1.51
13. Greece	1.75
14. Turkey	2.88
15. Venezuela	0.47
16. Indonesia	1.65
17. Nigeria	1.98
18. Bolivia	3.03
19. Peru	1.80
20. Brasil	1.08
21. Argentina	5.81
22. Malaysia	1.19
23. Singapore	1.36
24. Thailand	0.77
25. India	1.41
26. Pakistan	1.17
27. Phillipines	1.38
28. Korea	1.26
29. Burma	2.77
30. South Africa	1.13
31. Marokko	1.58
32. Tunesia	1.70
33. Kenia	1.28
34. Ivory Coast	2.81
35. Malawi	2.24
36. Senegal	2.60
37. Israel	2.10
38. Upper Volta	4.30
39. Zaire	5.19

Source : IMF, International Financial Statistics.

2. THE MODEL

In this section we develop a model which endogenizes the short term deviations of the exchange rate around its PPP value. The model draws heavily on Aizenman (1984) and extends it so as to derive testable propositions. The model is based on two strands of economic thinking about exchange rates, one is the sticky price model (Dornbusch (1976)), the other is the "news"-model of exchange rate determination (Mussa (1976), Frenkel (1976)).

Consider a small open economy with perfect capital mobility. Money market equilibrium is obtained when the demand for money (m_t^d) equals the supply (m_t^s). The money demand function is specified in log-linear form i.e.

$$m_t^d = p_t + y_t - \alpha r_t \quad (1)$$

where m_t^d is the log of the demand for money in period t , p_t is the log of the price level in period t , y_t is the log of the output level in period t and r_t is the domestic interest rate in period t . Note that for the sake of convenience we have assumed that the income elasticity of the demand for money is equal to one. Money market equilibrium implies

$$m_t^d = m_t^s = m_t \quad (2)$$

or

$$m_t = p_t + y_t - \alpha r_t \quad (3)$$

The domestic interest rate is assumed to be determined by uncovered interest parity

$$r_t = r_t^{\star} + E_t e_{t+1} - e_t \quad (4)$$

where $r_t^{\star}$ is the foreign interest rate, $E_t e_{t+1}$ is the expectation in period t of next period's exchange rate. Note that we disregard here the existence of risk premia.

We now introduce the idea that there is some form of price stickiness. In a first step we just assume price stickiness, in a second step the degree of price stickiness is made endogenous, by explicitly specifying the nature of the transactions cost in the goods market. Suppose that the price of the domestic good in period t is set at the end of period $t-1$ on the basis of expectations which then prevail about the PPP - level in period t . Thus

$$p_t = E_{t-1}(p_t^{\star} + e_t) \quad (5)$$

The implicit assumption of this price setting behavior is that transactions costs are high enough to prevent a flow of goods from (or to) the world, which would equalize goods prices during period t . We will relax this assumption later.

Substituting (5) into (3), and (4) into (3) yields an expression for the exchange rate, i.e.,

$$e_t = \frac{1}{\alpha} [m_t - y_t + \alpha r_t^{\star}] - \frac{1}{\alpha} [E_{t-1}(p_t^{\star} + e_t)] + E_t e_{t+1} \quad (6)$$

We can now contrast the exchange rate obtained in (6) with the exchange rate obtained assuming complete price flexibility. The latter implies that

$$p_t = p_t^{\star} + e_t \quad (7)$$

i.e., the domestic price level adjusts instantaneously to its PPP-level.

Substituting (7) into (3) and using the notation $\bar{e}_t$ and $\bar{p}_t$ to indicate that this is the solution under price flexibility, yields

$$\bar{e}_t = \frac{1}{\alpha} [m_t - y_t + \alpha r_t^*] - \frac{1}{\alpha} [p_t^* + \bar{e}_t] + E_t \bar{e}_{t+1} \quad (8)$$

Subtracting (8) from (6) yields

$$e_t - \bar{e}_t = \frac{1}{\alpha} [\bar{e}_t + p_t^* - E_{t-1}(p_t^* + e_t)] + E_t e_{t+1} - E_t \bar{e}_{t+1} \quad (9)$$

The rational expectations solutions of (6) and (8) are given by ¹⁾

$$e_t = \frac{1}{1+\alpha} \sum_{k=0}^{\infty} E_t B_{t+k} \left(\frac{\alpha}{1+\alpha}\right)^k + \frac{1}{\alpha} \left[\frac{1}{1+\alpha} \sum_{k=0}^{\infty} (E_t B_{t+k} - E_{t-1} B_{t+k} \left(\frac{\alpha}{1+\alpha}\right)^k) \right] \quad (10)$$

and

$$\bar{e}_t = \frac{1}{1+\alpha} \left[\sum_{k=0}^{\infty} E_t B_{t+k} \left(\frac{\alpha}{1+\alpha}\right)^k \right] - \frac{p_t^* - E_{t-1} p_t^*}{1+\alpha} \quad (11)$$

where $B_t = E_{t-1} e_t - \alpha E_t e_{t+1} + \alpha$

From (10) and (11) it follows that in both pricing regimes

$$E_t e_{t+1} = E_t \bar{e}_{t+1}$$

so that (9) reduces to

$$e_t - \bar{e}_t = \frac{1}{\alpha} [\bar{e}_t + p_t^* - E_{t-1}(\bar{e}_t + p_t^*)] \quad (12)$$

1) We assume that the information set includes knowledge of the current shocks. Also we disregard the bubble component of the solution. See also Aizenman (1984), p. 178.

or

$$e_t - \bar{e}_t = \frac{1}{\alpha} [\bar{p}_t - E_{t-1}\bar{p}_t] \quad (13)$$

Equation (13) tells us that the exchange rate under the pre-set price rule will deviate from the exchange rate under price flexibility to the extent that economic agents make errors in forecasting the price level (i.e. the world price and the exchange rate).

Using (5) and (7), we can rewrite equation (13) as follows

$$\theta_t \equiv e_t + p_t^* - p_t = (1 + \frac{1}{\alpha}) [\bar{p}_t - E_{t-1}\bar{p}_t] \quad (14)$$

where θ_t is the percentage deviation from PPP. According to (14) deviations from PPP in period t increase with the size of the unanticipated price disturbances.

The model discussed here has a simple graphical representation (see figure 1). The aa -line is the asset market equilibrium line (equations (3) and (4)). It is given for a given foreign interest rate and the expectations prevailing in period t about the future exchange rate. The PPP line represents equation (7).

We can now use the model to analyze the effects of exogenous disturbances. The major focus of this analysis is the question of how the size of the disturbances affects the workings of the model. Here we consider only stochastic (unanticipated) disturbances, and assume that these disturbances are a random variable in the money market equilibrium condition (3).

In terms of figure 1 we now obtain random movements of the aa -line. Depending on the size of the stochastic disturbances the aa -line will be displaced between the limits set by aa_L and aa_U . In the sticky price version of the model this implies that as the price level is pre-set at $E_{t-1}\bar{p}_t$, the nominal and real exchange rates will fluctuate between the limits set by points H and F and will be perfectly correlated. To give an example, suppose that an unanticipated disturbance has shifted the aa -line in period t to aa_U . As the price level cannot change in period t ,

Figure 1 : The model with price stickiness

the short-term equilibrium point is F. (The equilibrium point under price flexibility is at G). The deviation from PPP is measured by the distance EF.

When the underlying stochastic disturbances increase, the band given by aa_L and aa_U increases so that the short-term deviations from PPP also increase.

The next step in the analysis consists in making the nature of the transaction costs (which explain price stickiness) explicit. This then allows us to make the degree of price stickiness endogenous.

It will be assumed here that transactions costs are proportional. They originate from transporting goods across borders. Thus, we assume that there is no transaction costs involved in trading domestic goods in the domestic market. The per unit transaction cost is C . We then have the following pricing rule :

$$\text{if } |\theta_t| < C \rightarrow p_t = E_{t-1}(e_t + p_t^*) \quad (15)$$

$$\text{if } |\theta_t| \geq C \rightarrow p_t = p_t^* + \bar{e}_t \pm C \quad (16)$$

Equation (15) says that if the deviation from PPP (θ_t) is smaller than the cost of transporting goods (C), the price of the domestic good is not influenced by $p_t^* + e_t$, i.e., it will not be profitable during period t to ship goods across borders in order to profit from a differential between the domestic and foreign price. In this case the price is pre-set at its expected PPP-level. Thus, we also assume there are no domestic forces tending to change the price during period t . If, however, the deviations from PPP exceed transport costs (equation (16)), goods arbitrage will be undertaken during period t because it is profitable. Put differently, if $p_t > p_t^* + \bar{e}_t + C$ the foreign good will be imported forcing p_t to equal $p_t^* + \bar{e}_t + C$. If $p_t < p_t^* + \bar{e}_t - C$ the domestic good will be exported forcing p_t to equal $p_t^* + \bar{e}_t - C$.

The effect of transaction costs as specified in equations (15) and (16) on the working of the model is also represented in Figure 2. The existence of transaction costs now introduces a band around the PPP-line within which price stickiness will occur.

It can easily be shown that the degree of price stickiness depends on the size of the stochastic disturbances in the aa -line. If these are small compared to the transaction cost band around PPP, prices will be sticky in the short run. We will observe points on the line segment AB . One implication of this is that there will be a perfect correlation between the nominal (e_t) and the real exchange rate (θ_t). If the stochastic disturbances increase in size, say between the limits given by aa_L and aa_U , we will observe points on the line segments $CABD$. Thus the price level becomes flexible, preventing the exchange rate to deviate from PPP by more than $\bar{\theta}$. One implication is that the correlation between the nominal and the real exchange rate declines. In the limit when the stochastic disturbances in the aa -line become very large relative to the transactions band around PPP the

correlation between the nominal and the real exchange rate tends to zero. By the same token the correlation between the nominal exchange rate and the price level increases when the size of the monetary disturbances increases. In the limit this correlation tends to 1 when the monetary disturbances become very large relative to the transactions band.

The theoretical model discussed here also allows us to analyze the importance of structural factors, such as the openness of the economy and the proximity to foreign markets, for the movements of the real exchange rate.

In more open economies the cost of shipping goods across borders will generally be lower than in relatively closed economies or in economies with a large degree of protection. Thus, in open economies with liberal trade policies the transaction cost band around the PPP-line will be smaller than in less open and more protected economies. As a result, the maximum deviation from PPP will be smaller in the former than in the latter. This difference, however, will become apparent only when the size of the monetary disturbances is large enough to produce real exchange rate changes that hit the ceiling imposed by the transaction cost band around PPP.

Figure 2 : The model with endogenous price stickiness

3. EMPIRICAL EVIDENCE

The theory developed in the previous section allows us to derive the following testable propositions :

- (1) When the size of monetary disturbances increases, the variability of the real exchange rate increases. Thus, we expect a positive correlation between monetary variability and the variability of the real exchange rate.
- (2) The relation between monetary variability and real exchange rate variability is non-monotonic, i.e. when monetary variability becomes large enough relative to the transaction cost band exchange rate variability stops increasing.
- (3) With low monetary variability the correlation between nominal and real exchange rates is high. When the size of monetary disturbances increases the correlation between nominal and real exchange rates declines and the correlation between the nominal exchange rates and the price level increases. These propositions are another way to formulate the nonlinear relationship between monetary and real exchange rate variability.
- (4) The size of real exchange rate variability declines with the degree of openness of a country.

In order to test these propositions it is important to have a sample of countries with divergent monetary regimes. We selected a sample of 39 countries during the period 1970-1983 ¹⁾. This sample includes both industrialized countries and developing countries, and countries with low and high inflationary experiences.

1) All the data are from the IFS-tape. Only 39 countries could be selected. For the other countries in the IFS database monthly data on prices and exchange rates are lacking. The list of countries selected is presented in table 1.

3.1. MONETARY VARIABILITY AND REAL EXCHANGE RATE VARIABILITY

In order to test the first proposition, regressions were performed using this cross-section of countries. As explanatory variables two measures of monetary variability are selected. One is the mean absolute monthly change of the money stock (M2), the other is the standard deviation of the monthly change of the money stock.

The estimated equations were specified as follows :

$$\log \bar{R}_i = \alpha + \beta \log \bar{M}_i + u_i \quad (17)$$

and

$$\log \bar{R}_i = \alpha' + \beta' \log \sigma_{M_i} + v_i \quad (18)$$

where $\bar{R}_i$ = the mean absolute rate of change of the real exchange rate of country i relative to the dollar, during 1970-1983.

$\bar{M}_i$ = the mean absolute monthly growth rate of the money stock (M2) of country i during 1970-1983.

σ_{M_i} = the standard deviation of the monthly growth rate of M2 of country i during 1970-1983.

The results of the estimation are given in table 2. They indicate that the size of monetary variability (measured by $\bar{M}_i$ or σ_{M_i}) had a significant positive effect on the short term real exchange rate change during 1970-1983. Note that the results are better when we use the standard deviation of money growth as proxy for monetary variability. Thus, the results confirm that countries which experienced a higher variability of the money growth also experienced higher real exchange rate variations than countries with lower monetary variability.

Table 2 : Estimates of regression equation (17) and (18)

Equation (17)	α	β	R^2	SER
	0.59 (1.87)	0.59 (4.90)	0.39	0.86
Equation (18)	α'	β'	R^2	SER
	0.60 (2.41)	0.66 (6.27)	0.51	0.77

Note : The numbers between brackets are t-statistics; SER is the standard error of the regression.

The next step in the analysis was to test for non-linearity of the relationship between real exchange rate change and the size of the monetary shocks. From the theory derived in the previous section, one expects that as the size of monetary disturbances continues to increase the size of the real exchange rate movements tends to level off. At a certain point (as determined by the transaction costs band) further increases in the size of monetary disturbances does not increase the real exchange rate variability. To test for this proposition a non-linear (logistic) curve was specified as follows :

$$\bar{R}_i = C + \exp \left(a - \frac{b}{X_i} \right) \quad (19)$$

where X_i represents the monetary variability, which is $\bar{M}_i$ and σ_{M_i} alternatively

The result of the estimation of this equation is presented in table 3.

Table 3 : Estimates of regression equation (19)

	C	a	b	SER
$X_i = \bar{M}_i$	1.56 (8.11)	2.91 (5.05)	10.48 (3.43)	0.84
$X_i = \sigma_{M_i}$	1.49 (8.22)	2.60 (7.32)	7.88 (4.38)	0.75

These results suggest a small improvement of the non-linear specification. The standard error of the regression (SER) is reduced, although only marginally, and the significance of the coefficients is enhanced. As these improvements of the non-linear specification turn out to be relatively small we do not want to draw strong conclusions at this stage. We take up this problem of non-linearity in the next section where we present evidence on the correlation between nominal and real exchange rate changes.

3.2. NOMINAL EXCHANGE RATES, REAL EXCHANGE RATES AND THE PRICE LEVEL

The theory developed in section 2 allowed us to derive two testable propositions concerning the correlation pattern between nominal and real exchange rates, and between nominal exchange rates and price levels. In this section the empirical evidence is presented.

The empirical tests were devised as follows. First, the correlations between the monthly changes of the real and of the nominal exchange rates were computed for each of the 39 countries in the sample during 1970-1983. The theory predicts that in countries with low monetary variability this correlation coefficient will be high, and vice versa.

Therefore, in the second step these correlation coefficients were related to the size of the monetary disturbances of each country during the same period, as measured by the mean absolute monthly change of the money stock.

In a similar way the correlation coefficients between price changes and changes in the nominal exchange rates were computed for each country during 1970-1983. These correlation coefficients were then related to the same measures of monetary variability. From the theory one expects that countries with low monetary variability are countries where the correlation between price changes and nominal exchange rate changes is low, and vice versa.

The regression equations were specified as follows :

$$\text{Cor}(R_i, e_i) = a + b\bar{M}_i \quad (20)$$

$$\text{Cor}(R_i, e_i) = a' + b'\sigma_{M_i} \quad (21)$$

$$\text{Cor}(p_i, e_i) = c + g\bar{M}_i \quad (22)$$

$$\text{Cor}(p_i, e_i) = c' + g'\sigma_{M_i} \quad (23)$$

where $\text{Cor}(\quad)$ is the correlation coefficient between the two variables in the bracket; $\bar{M}_i$ is the mean absolute monthly change of the money stock of country i during 1970-1982, σ_{M_i} is the standard deviation of the monthly growth rate of the money stock of country i during 1970-1982, R_i is the percent change of the real effective exchange rate of country i , and e_i is the percent change of the nominal exchange rate of country i .

The results of these empirical tests are presented in table 4 and 5. Table 4 shows the correlation coefficients between nominal and real exchange rate changes, and between price changes and changes in the nominal exchange rates. We have also added a column with the mean absolute monthly change of the money stock for each country, and one with the standard

deviation of the same variable. Table 5 then presents the results of regressing equations (20) to (23). These results confirm the theoretical predictions, i.e. the coefficient of the monetary variability variable has the correct and significant negative sign in the regressions explaining the correlation between nominal and real exchange rates, and the coefficients of the monetary variability variable in the regression explaining the correlation between nominal exchange rates and prices are have the expected positive sign. Thus, countries which experienced relatively little variability in the money stock are also the countries where the correlation between nominal and real exchange rate changes is high. On the other hand, as the regression coefficients of the monetary variable in equations (22) and (23) indicate, these same countries experienced low correlations between price changes and changes in the nominal exchange rate. The opposite holds for countries experiencing high monetary variability. In these countries the correlation between nominal and real exchange rate changes tended to be lower, and the correlation between price changes and changes in the nominal exchange rates tended to be higher ¹⁾.

This evidence also provides indirect confirmation of the theoretical proposition concerning the non-monotonic relation between monetary variability and real exchange rate changes.

1) In another paper these correlations were analyzed for the German hyperinflation, see P. De Grauwe et al. (1984). It was found that in this situation of extreme monetary disturbances, the correlation between nominal and real exchange rate changes is close to zero, whereas the correlation between the price changes and the changes in the nominal exchange rates was close to one.

Table 4 : Correlations coefficients between nominal and real exchange rates changes and between nominal exchange rate and price level changes

Country	$\text{Cor}(p_i, e_i)$	$\text{Cor}(R_i, e_i)$	M_i	σ_{M_i}
1. Germany	0.11	0.97	1.16	0.95
2. Switzerland	0.05	0.97	1.27	2.42
3. Austria	0.03	0.96	1.04	0.90
4. Netherlands	0.06	0.95	1.14	0.94
5. Canada	0.04	0.88	1.35	0.87
6. Norway	0.14	0.93	2.55	2.18
7. France	0.22	0.98	1.55	1.26
8. Japan	0.06	0.90	1.54	1.17
9. Denmark	0.13	0.92	1.68	1.29
10. United Kingdom	0.15	0.87	1.47	1.21
11. Italy	0.31	0.92	1.74	2.24
12. Spain	0.15	0.90	1.71	1.38
13. Greece	0.23	0.67	1.94	1.99
14. Turkey	0.43	0.91	3.32	3.00
15. Venezuela	0.08	0.36	2.43	2.26
16. Indonesia	0.04	0.87	2.65	2.10
17. Nigeria	0.16	0.25	3.24	2.71
18. Bolivia	0.49	0.93	3.39	3.49
19. Peru	0.19	0.83	3.40	2.78
20. Brasil	0.69	0.72	4.28	2.92
21. Argentina	0.37	0.86	6.73	7.03
22. Malaysia	0.13	0.89	1.55	1.19
23. Singapore	0.23	0.75	1.46	1.18
24. Thailand	0.12	0.68	1.53	1.02
25. India	0.20	0.67	1.58	1.18
26. Pakistan	0.01	0.99	1.75	1.74
27. Philippines	0.01	0.94	2.25	1.99
28. Korea	0.14	0.92	2.24	1.45
29. Burma	0.08	0.67	1.79	1.77
30. South Africa	0.11	0.95	1.51	1.05
31. Marokko	0.21	0.82	1.50	1.25
32. Tunesia	0.20	0.83	1.86	1.57
33. Kenia	0.05	0.74	2.08	1.48
34. Ivory Coast	0.00	0.55	3.52	2.76
35. Malawi	0.00	0.43	3.22	2.72
36. Senegal	0.01	0.44	3.54	3.99
37. Israel	0.60	0.82	4.17	3.21
38. Upper Volta	0.05	0.18	2.61	2.12
39. Zaire	0.23	0.76	3.67	3.67

Table 5 : Results of estimating equations (20) to (23)

	a	b	a'	b'	R ²	SER
Equation (20)	0.91 (12.40)	-0.05 (-1.87)			0.09	0.20
Equation (21)			0.87 (13.0)	-0.04 (1.44)	0.05	0.20
	c	g	c'	g'	R ²	SER
Equation (22)	0.003 (0.06)	0.070 (3.55)			0.25	0.14
Equation (23)			0.51 (1.05)	0.06 (2.77)	0.17	0.15

3.3. THE IMPORTANCE OF STRUCTURAL FACTORS

The theoretical model predicts that when transactions costs involved in trading goods internationally are low the variability of real exchange rates will tend to be low, ceteris paribus.

In order to test for this hypothesis we need proxies that indicate the extent to which transactions costs differ across countries. Two proxies were selected. The first one is the degree of openness (the share of exports in GDP). In general one expects that in more open economies the cost of transacting with other countries will be smaller than in more closed economies. This proxy measures the average degree of openness of a country during the sample period. A second proxy is the growth rate of exports relative to GDP. This measure can be interpreted as the marginal degree of openness of a country. One expects that in a growing world those countries that have a relatively liberal trading system (with low impediments to trade, and thus low transactions cost) experience a faster growth of the share of exports in GDP than countries with a less liberal trading system. Thus a country which experienced a growth rate of its

export share in GDP above the average in the sample during 1970-1983 is a country in which economic agents faced relatively low transactions cost when trading internationally.

Similar equations as (17) and (18) were estimated adding these two proxies of transactions costs (called D_1 and D_2 respectively). The results are presented in table 6.

Table 6 : Estimates of regression equations (17) and (18) with proxies for openness

Equation (17)	α	β	D_1	D_2	R^2	SER
	0.67 (1.44)	0.59 (4.75)	-0.003 (-0.24)		0.39	0.87
	1.79 (2.62)	0.56 (4.78)		-0.009 (1.95)	0.45	0.83
Equation (18)	α'	β'	D_1	D_2	R^2	SER
	0.66 (1.67)	0.66 (6.10)	-0.002 (-0.17)		0.52	0.78
	1.57 (2.54)	0.63 (5.99)		-0.008 (1.70)	0.55	0.75

Note : D_1 is the average openness variable, D_2 is the marginal openness variable.

The results of table 6 tend to confirm the theoretical hypothesis. Both proxies of transactions costs have the expected negative sign. However, the coefficient of the first proxy (D_1) is not significantly different from zero. The second proxy (D_2) has a coefficient significantly different from zero. This suggests that countries which experienced a high growth rate of exports relative to GDP (and which we interpret as reflecting relatively small transactions cost) were countries facing small short term real exchange rate variability (for a given monetary variability), compared to other countries.

Other structural factors might influence the size of real exchange rate variability. In particular, we want to test whether there could be a difference between developed and developing countries. Therefore, the equations were run separately for the developed and the developing countries, and the F-ratio was computed to test for the significance of the difference in the estimated equations. These F-ratios are shown in table 7.

Table 7 : F-test for difference between DCs and LDCs.

Equation (17)	F-ratio
Marginal openness	1.43
Average openness	0.86
Equation (18)	
Marginal openness	1.56
Average openness	0.80

It can be seen that the F-ratios fall short of the critical F-value which is 3.25. Thus, the hypothesis of structural difference between DCs and LDCs must be rejected.

4. CONCLUSION

The short term deviations from Purchasing Power Parities have been substantial since the advent of floating exchange rates. In addition, the experience of different countries has been quite different in this area.

In this paper we used and extended a model endogenizing short-term real exchange rate variations. The thrust of the model is that real exchange rate variability increases with the size of monetary disturbances. However, as the degree of price flexibility is itself a positive function of the size of monetary disturbances, this relation between monetary and real exchange rate variability is a non-linear one. That is, when monetary disturbances increase beyond a certain level it will be worthwhile for economic agents to make quicker price adjustments, thereby limiting further deviations of the exchange rate from PPP. The theory, however, does not allow to conclude that PPP holds better in a hyperinflationary environment. In fact, deviations from PPP achieve their highest level in such an environment.

The theoretical model was tested with a sample of countries during 1970-1983. In general, the results were favorable. In addition, the theory allowed us to explain why the correlation pattern between nominal and real exchange rate changes, and between changes in the price level and the nominal exchange rate diverge between countries with high and low monetary disturbances.

Much of the theorizing about the determinants of exchange rates has been influenced by "stylized facts" observed during the seventies and the early eighties for the major currencies. These stylized facts are the strong positive correlation between nominal and real exchange rate changes in the short run, and the weak correlation between price changes and nominal exchange rate changes in the short run. This has contributed to the popularity of the sticky price models of exchange rate determination.

In this paper we stressed that these stylized facts are not universal phenomena. They are not found in countries with monetary regimes which are drastically different from those prevailing in the industrialized countries. The model developed here allowed us to better understand the divergent exchange rate experiences of a large sample of countries.

To conclude, the limitations of the present study should be stressed. Differences in monetary variability explain about 40 % of the cross-country differences in real exchange rate variability. There is thus a lot more to be explained. It is clear that further work will have to focus on structural and "real" variables (e.g. terms of trade changes, supply shocks etc.).

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