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THE U.S. MONETARY POLICY REGIME, INTEREST DIFFERENTIALS AND DOLLAR EXCHANGE RATE RISK PREMIA

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ABSTRACT

It is commonly believed that the Federal Reserve targeted money growth directly and allowed greater variation in interest rates during the October 1979-October 1982 period. Other things the same, this policy regime would be expected to increase the risk premium on the dollar exchange rate relative to a regime that attempted to reduce variations in the interest rate. We find that risk premia apparently did increase during the regime of M1 targeting. This implied that failure to recognize the effects of changes in Fed policy is a source of specification error in exchange rate models.

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The U.S. Monetary Policy Regime, Interest Differentials and Dollar Exchange Rate Risk Premia

The asset approach to exchange rate determination, which treats currencies more as claims on assets in their countries of issue rather than as claims on the future flows of the trading partners' exports, includes interest and inflation differentials as its principal explanatory variables. The current account balance, which had been the dominant explanatory variable in exchange rate models based on trade flows, still is included in some models constructed to test exchange rate hypotheses. Now, however, the typical justification for its inclusion is as scale variable for wealth changes.

This increased emphasis on interest differentials can be traced to the seminal paper on exchange rate dynamics by Dornbusch (1976) and to a sequence of contributions by Frenkel (including 1976, 1981) emphasizing changes in information in efficient foreign exchange markets. An important gap in this literature, however, is the policy stance of the monetary authorities. Despite their implications for changes in expected inflation and real interest rates (e.g. Roley (1983); Frankel and Hardouvelis (1985)), changes in monetary regimes have received relatively little direct attention in empirical models of changes in the exchange rate. In fact, the monetary regime has been given only implicit attention insofar as it affects the expected inflation rate (which affects the interest rate differential) or the actual inflation rate (which affects the purchasing power parity long run equilibrium).

In this note we demonstrate that the choice of a target variable for U.S. monetary policy has clear and empirically demonstrable implications for the risk premium on the dollar's exchange rate and its relation with interest differentials. Stated most simply, the risk premium should be lower under a regime of interest rate targeting than under one of money stock targets in which the interest rate is market-determined. Interest rate differentials should have more significant impact when they reflect market differences solely rather than policy manipulations which may subsequently be reversed. These effects are isolated by investigating how coefficients associated with the interest differential and the current account balance vary under alternative monetary policy regimes.

I. ASSET BASED EXCHANGE RATE MODELS

The covered parity condition and market efficiency imply the identity

$$(1) \qquad e_t = \hat{e}_{t+1} + (i^*_t - i_t) + \sigma_t,$$

where $e \equiv$ spot exchange rate (foreign currency units per dollar),

$\hat{e} \equiv$ expected future spot exchange rate based on current information,

$i \equiv$ interest rate,

$\sigma \equiv$ a risk premium for bearing the relative risk or uncertainty of non-dollar currencies,

with lower case letters denoting logarithms (except interest rates), and asterisks indicating non-U.S. values; see Isard (1983). If the risk premium is identically zero, then the equation describes the much stronger condition called uncovered interest parity. This identity can be given empirical content in two ways. First, the risk variable can be defined and associated with observable proxy variables. Second, the possibility of non-contemporaneous adjustment implies a lag structure which can be specified.

I.A <u>Implications of Exchange Rate Risk</u>

Isard (1983) aptly summarizes the necessary conditions for the risk premium to exist in (1):

> A nonzero risk premium owes its existence to three factors: (i) a nonzero probability, and hence some risk, that the future spot exchange rate differs from its expected value, (ii) private investors' aversion to that risk, and (iii) a difference between the currency composition of public debts that are forced (at market-clearing prices) into the portfolios of private investors (as an aggregate) and the currency composition of the aggregate portfolio that would minimize the risk assumed by private investors.... Without any one of these factors the risk premium would vanish. (Isard (1983), p. 35)

The risk variable in (1), since its sign is positive, measures the riskiness of non-dollar-denominated assets relative to dollar assets; that is, a rise in σ raises the non-dollar price of a dollar.

For purposes of this paper, we consider two forms of risk--systemic and policy. Systemic risk is the endogenous risk that as portfolios accumulate, say, more and more dollar assets, the yield that future marginal dollar investments would have to earn may rise.[1/] Note that in terms of the definition of σ, this is an increase in the negative risk premium or risk discount. Alternatively, the increase in negative σ_t requires an offsetting rise in $(i_t - i_t^*)$ if e_t is not to decline. Thus, as the risk of such a rise in $-\sigma_t$ increases, the yield current investors demand also will rise, causing the dollar's real exchange value to fall below the level implied by purchasing power parity, $\hat{e}$, by <u>more</u> than the amount that can be ascribed to the real interest differential. The proxy commonly employed in empirical exchange rate studies to reflect this asset accumulation is the cumulative current account balance; see Hooper and Morton (1982).

The other foundation of a risk premium is the possibility of short-term relative interest rate movements due to variation in the relation between the instruments of monetary policy and the target of monetary policy. Under a policy of money-growth-rate targeting, movements in interest rates (and, hence, changes in interest differentials) are market-determined without the dampening implied by a policy of interest-rate targeting. If U.S. interest rates are more variable under monetary targeting than under interest-rate targeting, then non-U.S. interest rates may be higher to compensate for the implied greater risk; consequently, the same interest differential will imply a higher exchange value for the dollar under a policy of monetary targeting than under an alternative policy regime; see Dornbusch (1983).[2/]

The empirical implications of this policy dichotomy are twofold. First, there should be a significant difference in the coefficient vector between periods of monetary targeting and alternative policy targets; in particular, the coefficient on the interest differential should be larger under U.S. monetary targeting. Second, in a regression equation based on (1), the intercept should be larger during periods of monetary targeting than during periods under alternative policy regimes.

$$(2) \qquad \Delta e_t = a_0 + a_1 d + b_0 \, \Delta(i_t - i_t^*) + b_1 d\Delta(i_t - i_t^*) + \Delta \hat{e}_{t+1} + \mu_t,$$

where d is a 0/1 - dummy variable taking the value one during IV/1979-III/1982 and zero otherwise. As a proxy for the unobservable change in the expected spot exchange rate, we follow the Hooper-Morton hypothesis that

$$(3) \qquad \Delta\hat{e}_{t+1} = c \, \Delta ccab_t$$

where Δccab is the <u>change</u> in the <u>cummulative</u> current account balance -- i.e., the current account balance. Substituting the right-hand side of (3) into (2) yields

$$(4)\qquad \Delta e_t = a_0 + a_1 d + b_0\Delta(i_t - i_t^*) + b_1 d\Delta(i_t - i_t^*) + c\Delta ccab_t + \mu_t.$$

I.B Non-Contemporaneous Adjustment and the Lag Structure

There is some evidence of non-contemporaneous adjustment in empirical exchange rate models; for example see Frankel and Hardouvelis (1985); this may be due to a model misspecification or inadequate proxies for the unobserved expected variables--the interest rate and the expected purchasing power parity exchange rate. Alternatively, and more damaging for exchange rate models based on rational expectations, this is a refutation of the efficient market hypothesis implicit in (1). In any case, lagged changes of the interest differential and levels of the current account balance (cab) were added to (4) so that the regression equation becomes

$$(5)\quad \Delta e_t = a_0 + a_1 d + \sum_{i=0}^{1} b_{0i}\, \Delta(i_{t-i} - i_{t-i}^*) + \sum_{j=0}^{1} b_{1j}\, d\Delta(i_{t-j} - i_{t-j}^*) + \sum_{k=0}^{1} c_k\, cab_{t-k} + \mu_t,$$

Several testable hypotheses are implied for (5) by the discussion preceding it and standard theory: First, in an efficient market, information from past periods should be incorporated in current prices. Three tests of this maintained hypothesis are that the intercept (a_0) should be zero, the residuals (μ_t) should be uncorrelated, and coefficients on lagged variables (b_{0i}, b_{11}, c_1) should be insignificant. Second, the intercept and slope dummies provide a means of separating the period of U.S. monetary aggregates targeting from periods of alternative monetary policy regimes; they have the value 1.0 during M1-target regime (IV/1979-III/1982) and are zero during other regimes. The risk premium hypothesis is that the intercept and contemporaneous slope dummies will have a significantly positive coefficient that reflects a greater dollar exchange rate risk premium when interest rates are market determined.

II. EMPIRICAL RESULTS

Equation (5) was estimated with quarterly data over the interval II/1976-II/1987. The exchange rate is the Federal Reserve Board's nominal trade-weighted exchange rate index (TWEX).[3/] The interest differential series are 3- to 6-month nominal U.S. and trade-weighted foreign interest rates. The exchange rate and interest rate data are last day of quarter data.[4/] The variable cab is the change in the cumulative current account balance which is simply the U.S. current account balance. As a reference point, we first report a restricted (no dummies) version of equation (5) to use as a benchmark in testing the significance of the dummy variable added sequentially in rows 2-6 of the table.

The restricted equation's estimate is reported in row 1 of Table 1; the adjusted R^2 ($\bar{R}^2$) is moderate at .167, but, more substantively, the estimate apparently rejects two of the three efficient market hypotheses. That is, while the intercept and lagged changes in the interest differential are insignificant, consistent with market efficiency, the lagged current account balance is significant, and the equation's residual term exhibits significant serial correlation. The latter indicates market inefficiency or misspecification; however, the lagged current account balance (cab) coefficient is less troubling than it seems.

The contemporaneous and lagged cab coefficients are apparently perverse, but their sum is insignificantly different from zero. The implied exchange rate effect, then, is that a fall in the cummulative cab (a deficit) causes a rise in the exchange rate (foreign currency price of the dollar) which is reversed by an offsetting decline in the next quarter. This effect is opposite to that described in the standard models following Hooper-Morton. Moreover, only a persistently rising or falling cab will have an impact on the foreign exchange value of the dollar. In contrast, a steady cab -- whether large, small, positive or negative -- has no impact on the exchange rate.[5/]

Row 2 of the table is the same equation supplemented by the intercept dummy. The $\bar{R}^2$ is higher, and the F-test for the additional variable rejects the null hypothesis of row 1. Serial correlation is in the uncertain range and lagged changes in the interest differential are insignificant, so market efficiency is not rejected. The coefficient on the contemporaneous change in the interest differential is significant at the 5 percent level compared with its 10 percent level of significance in the row 1 estimate; moreover, it remains insignificantly different from plus one. Other coefficients also are not affected much, although the contemporaneous cab coefficient is now significant at the 10 percent level.

Row 3 replaces the intercept dummy in row 2 with slope dummies. Neither residual serial correlation nor significance of lagged interest rate differentials challenges the maintained hypothesis of market efficiency, but the F-test for this specification does not reject the row 1 specification. Yet, focusing narrowly on the contemporaneous slope dummy, its coefficient is significant while the contemporaneous differential coefficient is now negative and insignificant. This implies that the contemporaneous interest differential is not significant during periods of non-monetary targeting regimes but is significant and not different from unity ($b_{00} + b_{01}$) during monetary targeting.

The row 4 specification adds both intercept and slope dummies to the row 1 specification. The $\bar{R}^2$ nearly doubles, there is no evidence of residual serial correlation, and the F-test rejects the null hypothesis of the row 1 specification. Lagged interest differentials are again not significant, and the cab coefficients now more precisely cancel out over two quarters. Nonetheless, the line 4 specification does not reject the null hypothesis -- intercept dummy only -- of line (2).

Finally, rows 5 and 6 omit the lagged interest differential slope dummy since neither the lagged difference nor its dummied variables are significant. Since the maintained efficient market hypothesis asserts the irrelevance of the lagged differential, it is consistent with the maintained hypothesis to test the marginal impact of the contemporaneous slope dummy by itself. The F-tests of the line 5 and 6 specifications indicate that the contemporaneous slope dummy should be included. The specifications reported in lines 5 and 6 each reject the null specification of line 1 at the 5 percent level. Comparing the line 6 specification with the line 2 null specification (intercept dummy only), the line 6 specification also rejects this null at the 5 percent level.[6/]

The interpretation of these specification tests is that the quantitative monetary regime during IV/1979-III/1982, had exchange rate adjustments with unitary coefficients on changes in interest differentials in efficient markets. During non-quantitative monetary regimes, changes in interest differentials were not significant determinants of exchange rate changes. Furthermore, changes in exchange rates reflected a significant risk-premium under the U.S. quantitative monetary policy regime -- i.e., for the same changes in right-hand side variables in equation (5), the exchange value of the dollar rose significantly more during IV/1979-III/1982 than in the other subperiods.

III. CONCLUSIONS

Asset models of exchange rate determination suggest several types of risk associated with holding assets denominated in dollars. These risks, which reflect changing expectations regarding future inflation and interest differentials, should vary directly with risks implicit under different monetary policy regimes. In particular, these risks should be lower when the Fed targets interest rates and should be higher when the Fed targets M1 growth and allows interest rates to vary in wider bands.

This proposition was tested in the context of a simple model of changes in the dollar's trade-weighted exchange rate. In each case, both the signs and significance of dummy variables and improvements in descriptive statistics of the estimated equations rejected the null hypothesis that risk premia were equal across monetary policy regimes.

Our results support the hypothesis that a monetary policy which does not interfere with market-determination of interest rates raises the risk premium on the dollar exchange rate. More provocative are two conjectures implied by our results which require further testing to establish. First, foreign exchange markets may be more efficient under a quantitative monetary regime than under alternative (interest-rate) monetary regimes in that changes in interest differentials convey clearer information. Second, the current account balance may be sustainable at substantial levels without implying exchange rate depreciation.

FOOTNOTES

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1/ This risk may be based on two distinct expectations. Investors may be concerned that fast growth in government debt eventually will impel the monetary authority to undertake faster monetary growth leading to an increased price level change not present in current inflation expectations. Alternatively, simply the increased proportion of dollar assets may move investors away from their optimally diversified portfolio; to hold the larger share in dollar assets, investors would demand higher yields on dollar assets. The cost of bearing the risk of this uncertain eventuality, not reflected in current interest differentials, is contained in the risk premium; see Dornbusch (1983).

2/ It is well known that the variance of U.S. interest rates, both nominal and real, has been higher during monetary target regimes than during alternative regimes; see, for example, Roley.

3/ Results for estimating (5) on any single bilateral exchange rate would be subject to two ambiguities of interpretation. First, the exchange rate movement may be due to a change in some institutional arrangement peculiar to the non-U.S. country, and, hence, not to be explained by the variables included in (5). Second, the change may be due to a shift in the market for, say, German or U.S. goods in some third country. Both of these ambiguities or omitted variable problems can be reduced by using an effective or weighted multilateral exchange rate which emphasizes U.S. changes as revealed by the mutual movements in foreign interest and exchange rates.

4/ A referee suggested that quarterly averages of daily data introduced autocorrelation in the interest rate and exchange rate series.

5/ Mussa (1985) conjectures exactly this independence in comments at a recent conference:

> ". . . the probable excess of desired saving over desired investment in many of the other industrial countries and the likely impediments to rechanneling the excess saving in the developing countries imply that the equilibrium level of the U.S. current account balance is probably one of substantial deficit." (p. 136, emphasis added).

Moreover, Mussa's conjecture also helps rationalize the apparently perverse signs of the cab_t, cab_{t-1} coefficients. Suppose the deficit is largely due to foreign demand for U.S. assets. Then a rise in cab (which is a rise in capital inflows) will be associated with a rising, not a declining exchange value of the dollar. This is the pattern of the estimated cab coefficients in Table 1.

6/ The test of the other specification restriction, i.e. line 5 vs line 6, also rejects the restricted specification with an F-statistic of 5.360, significant at the 5 percent level.

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Table 1. A Simple Model of Exchange Rate Changes and Tests for Changes in Risk Premia

Intercept		ΔRID_t		ΔRID_{t-1}		CAB_t, CAB_{t-1}		Summary Statistics		F-Tests	
a_0	a_1	b_{00}	b_{01}	b_{10}	b_{11}	c_0	c_1	$\bar{R}^2$	DW	(1)	(2)
0.0086		0.8086		0.2905		-0.0024	0.0037	.167	1.334*	-	-
(1.005)		(1.791+)		(0.645)		(1.552)	(2.250*)				
-0.0096	0.0391	0.9223		0.3096		-0.0029	0.0035	.255	1.475	5.600*	-
(0.861)	(2.366*)	(2.146*)		(0.727)		(1.926+)	(2.249*)				
0.0107		-0.9282	2.2905	0.7643	-0.3607	-0.0026	0.0039	.222	1.457	2.374	-
(1.285)		(1.016)	(2.179*)	(0.926)	(0.366)	(1.683+)	(2.413*)				
-0.0065	0.0366	-0.6926	2.1232	0.7324	-0.3123	-0.0030	0.0037	.301	1.593	3.494*	2.256
(0.596)	(2.280*)	(0.794)	(2.175*)	(0.936)	(1.334)	(2.043*)	(2.417*)				
-0.0106		-0.8447	2.2306	0.5103		-0.0026	0.0039	.328	1.488	4.724*	-
(1.288)		(-0.966)	(2.173*)	(1.155)		(1.756+)	(2.495*)				
-0.0066	0.0368	-0.6195	2.0708	0.5125		-0.0031	0.0037	.318	1.616	5.313*	4.509*
(-0.617)	(2.316*)	(0.743)	(2.124*)	(1.225)		(2.122*)	(2.496*)				

Note: Absolute values of t-statistics in parentheses; asterisk indicates significance at 5-percent level and + indicates significance at 10-percent level. F-tests are for significance of adding the dummy variables relative to null specification in line 1 (1) or adding slope dummies relative to specification in line 2 (2); dash indicates specifications not nested..