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**THE IMPACT OF CHANGES IN THE FEDERAL RESERVE'S DISCOUNT
RATE ON THE DOLLAR'S FOREIGN EXCHANGE VALUE**

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Kathleen H. Brown

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THE IMPACT OF CHANGES IN THE FEDERAL RESERVE'S DISCOUNT RATE
ON THE DOLLAR'S FOREIGN EXCHANGE VALUE

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Introduction

This paper attempts to analyze the effects of changes in the Federal Reserve's discount rate on the dollar's foreign exchange value. If a discount rate increase were to signal a subsequent general increase in market interest rates, one would expect U.S. dollar-denominated assets to become relatively more attractive, and the ensuing increased demand for dollar assets to tend to raise the dollar's exchange value. The reverse would be true for discount rate decreases. However, the Federal Reserve's policy of moving the discount rate with a lag behind the Federal funds rate means that market participants generally have sufficient information to anticipate changes in the discount rate. When this is the case, announcement effects -- immediate and discernable market responses to discount rate changes -- do not occur. Under special circumstances in 1978, however, announcement effects could and did occur. By increasing the discount rate when the Federal funds-discount rate differential was around normal levels and by increasing the discount rate by a larger amount than the market anticipated, the Federal Reserve used the discount rate as a signal to market participants that it would use other operating instruments to bring about changes in market interest rates and the monetary base.

This paper builds on the work of Raymond E. Lombra and Raymond G. Torto, who ran a number of econometric tests for discount rate exogeneity on monthly data from January 1968 to May 1974. They concluded that discount

*The comments and suggestions of Barbara Lowrey were very helpful, as were discussions with Paul Boltz, James O'Brien, Leigh Ribble and Ralph Smith.

The views expressed herein are those of the author and do not necessarily represent the views of the Federal Reserve System.

rate movements are not exogenous with respect to the spread between the discount rate and the Federal funds rate. Given rational expectations, therefore, changes in the discount rate cannot generate announcement effects.^{1/} This paper updates the work of Lombra and Torto and then attempts to test directly whether discount rate changes have had exchange market impacts over the past several years.

Methodology

The sample period used is January 2, 1973 to November 9, 1978, and the data in all cases are daily. The decision to estimate announcement effects using daily data is based on the assumption that announcement effects, by definition, are very short-lived. Instantaneous market communications allow financial variables to adjust rapidly to the news of a discount rate change. After a few days, any further movements in these financial variables are market adjustments to generally higher (lower) market interest rates rather than to the announcement of a higher (lower) discount rate. It is difficult, if not impossible, to separate these two types of adjustments when using time series of a lower frequency.

The equations have been estimated using two types of time series: (1) time series including every daily observation in the sample period and (2) segmented time series of daily observations in seven business-day intervals surrounding the twenty-four discount rate changes in the sample period. The latter is an attempt to isolate announcement effects and to exclude other market movements insofar as possible.

Finally, in order to examine the temporal stability of coefficients, an add-one-period/drop-one-period method of estimation is used.

^{1/} R. E. Lombra and R. G. Torto, "Discount Rate Changes and Announcement Effects," The Quarterly Journal of Economics, February 1977, pp. 171-176.

Re-examining the Lombra-Torto Premise

Lombra and Torto rule out the possibility of announcement effects on the basis of evidence that changes in the discount rate are determined by changes in the Federal funds rate. Table 1 shows the results of a repetition of the Lombra-Torto test for the 1973 to 1978 sample period. If changes in the discount rate are not independent of changes in the Federal funds rate-discount rate differential, a significant statistical relationship will exist.

Table 1
REGRESSION RESULTS^{a/}

<u>Period</u>	<u>Dependent Variable</u>	<u>Independent Variable</u>	<u>Sum of Distributed Lag Weights^{b/}</u>	<u>T Statistic</u>	<u>R⁻²</u>	<u>Mean Square Error</u>
1973-1975	DR _t	(FFR-DR) _{t-i}	.442	9.077	.964	0.025
1973-1976	DR _t	(FFR-DR) _{t-i}	.477	8.257	.972	0.027
1973-1977	DR _t	(FFR-DR) _{t-i}	.454	7.749	.974	0.024
1973-1978	DR _t	(FFR-DR) _{t-i}	.365	4.199	.950	0.055

DR = Discount rate
FFR = Federal funds rate
i = 1, 2, 3, 4

a/ The Cochrane-Orcutt adjustment for autocorrelation was employed, and the estimate for Rho was very close to one, indicating a first difference formulation.

b/ The distributed lag weights were estimated with a second-degree polynomial with no end point constraints.

Generally, the results confirm the Lombra-Torto conclusion that the discount rate is not independent of the Federal funds rate-discount rate differential. In fact, the estimated coefficient and R⁻² in the 1973 to 1977 case are nearly identical to the Lombra-Torto results. When 1978 is added to the sample period,

however, the R^2 drops slightly and the mean square error more than doubles.

To further examine the temporal stability of the results, the estimated parameters for 1973 to 1977 were used to forecast discount rate changes in 1978. Those changes Δ were applied to actual discount rates r_{t-1} to derive a discount rate level forecast for each month. The results are presented in Table 2.^{2/}

Table 2

<u>1978</u>	<u>Forecast</u>	<u>Actual</u>	<u>Forecast Error</u>
JANUARY	6.03	6.37	-0.34
FEBRUARY	6.36	6.50	-0.14
MARCH	6.50	6.50	.00
APRIL	6.52	6.50	.02
MAY	6.53	6.83	-0.30
JUNE	6.88	7.00	-0.12
JULY	7.04	7.23	-0.19
AUGUST	7.25	7.34	-0.09
SEPTEMBER	7.38	7.82	-0.44
OCTOBER	7.83	8.26	-0.43
NOVEMBER	8.28	9.5	-1.22

The Lombra-Torto hypothesis appears to have been quite viable from 1973 to 1977. In fact, the explanatory power of the lagged differential variable seems to have increased gradually over this period, as evidenced by the rising R^2 . However, the equation was not an adequate forecaster of discount rates in

^{2/} The discount rate is a monthly average of daily rates. The average difference between actual and fitted values over the sample period is .01.

1978, particularly toward the end of the year. It seems reasonable to assume that if discount rate changes last year were not entirely predictable on the basis of movements in the Federal funds-discount rate differential, those changes could have surprised the market and consequently have generated announcement effects.

A closer look at the timing and magnitudes of the discount rate changes in 1978 sheds some light on why announcement effects may have occurred. Table 3 shows discount rates, Federal funds rates and the differential between the two for segments of 1978 surrounding each of the seven changes in the discount rate. Given that the norm was a 50 basis point spread, the market may have been taken by surprise by the discount rate changes in January and September, since the differentials had not been far from that norm. The market may also have been surprised by the magnitude of the November discount rate change, since it was the largest since 1933.

Table 3

<u>Date</u>	<u>Discount Rate</u>	<u>Federal Funds Rate</u>	<u>Differential</u>
1-7-78	6	6.5	.5
1-8-78	6	6.5	.5
1-9-78	6.5	6.67	.17
1-10-78	6.5	6.65	.15
5-9-78	6.5	7.41	.91
5-10-78	6.5	7.33	.83
5-13-78	7	7.37	.37
5-14-78	7	7.37	.37
7-1-78	7	8.01	1.01
7-2-78	7	8.01	1.01
7-3-78	7.25	7.64	.39
7-4-78	7.25	7.64	.39
8-19-78	7.25	8.04	.79
8-20-78	7.25	8.04	.79
8-21-78	7.75	8.24	.49
8-22-78	7.75	8.24	.49
9-19-78	7.75	8.34	.59
9-20-78	7.75	8.38	.63
9-23-78	8	8.5	.5
9-23-78	8	8.5	.5

Table 3 (continued)

<u>Date</u>	<u>Discount Rate</u>	<u>Federal Funds Rate</u>	<u>Differential</u>
10-14-78	8	8.73	.73
10-15-78	8	8.73	.73
10-16-78	8.5	8.84	.34
10-17-78	8.5	8.76	.26
10-30-78	8.5	9.23	.73
10-31-78	8.5	9.35	.85
11-1-78	9.5	9.87	.37
11-4-78	9.5	9.94	.44

In summary, the evidence presented here suggests that announcement effects were possible in 1978, even by the Lombra-Torto standards. The rest of this paper examines the foreign exchange market for evidence that announcement effects did, indeed, occur.

The Foreign Exchange Market for Dollars

From a monetarist perspective, exchange rates are viewed as the relative prices of national monies. The actions of monetary authorities are seen as impacting on the foreign exchange market ultimately by altering relative money stock growth rates and relative rates of return on financial assets. These actions may have immediate effects on exchange rates by affecting the expectations of market participants about future monetary conditions, particularly about inflation differentials. A rise in U.S. interest rates relative to foreign interest rates will, ceteris paribus, make U.S. dollar-denominated assets relatively more attractive and stimulate flows of funds into dollars. In the same way, a tightening of monetary policy signals an expected deceleration of U.S. inflation and, ceteris paribus, will increase the amount of dollars people are willing

to hold. If such policy moves are perfectly anticipated in the foreign exchange market, no announcement effects of discount rate changes will be evident. If they are not perfectly anticipated, on the other hand, the discount rate change will contain news which will be utilized by the market. The result will be a change in the exchange value of the dollar in the same direction as the change in the discount rate.

In the following statistical experiments, changes in the weighted-average index of the dollar's exchange value^{3/} are regressed against changes in the discount rate. Changes in the Treasury bill rate were added as a second explanatory variable to insure that the discount rate variable was not also reflecting general interest rate movements. (The coefficients for this variable are not shown on the tables of regression results.)

Table 4A shows the results of regressions run on the entire series of daily data. Table 4B shows the results of regressions run on segmented time series, seven-day periods surrounding each change in the discount rate. Both sets of results show a significant impact of changes in the discount rate on changes in the value of the dollar for the period 1973 to 1978. The same variable is insignificant, however, from 1973 to 1977. This suggests that rather strong announcement effects were occurring in 1978. Re-estimation of the equation using smaller time periods, and adding and dropping one-year portions of the time series to test for the stability of the coefficient, yields similar results. Positive announcement effects seem to have occurred in 1978. This conclusion is further supported by the fact that the estimated coefficient is approximately the same in both the entire-array and segmented-array experiments.

^{3/} Federal Reserve Board index of the weighted-average exchange value of the U.S. dollar against currencies of other G-10 countries and Switzerland. Weights are 1972-1976 global trade shares.

Table 4A

REGRESSION RESULTS
January 2, 1973 to November 9, 1978
(entire data arrays)

<u>Period</u>	<u>Dependent Variable</u>	<u>Independent Variable</u>	<u>Coefficient</u>	<u>T Statistic</u>
1973 - 1977	ΔWAX	ΔDR	0.2332	1.0688
1973 - 1978	ΔWAX	ΔDR	1.1516	6.3686
1973 - 1975	ΔWAX	ΔDR	0.2830	0.9707
1974 - 1976	ΔWAX	ΔDR	0.1994	0.7100
1975 - 1977	ΔWAX	ΔDR	-0.0955	-0.4446
1976 - 1978	ΔWAX	ΔDR	1.9660	9.1261

Table 4B
REGRESSION RESULTS
(segmented data arrays)

<u>Period</u>	<u>Dependent Variable</u>	<u>Independent Variable</u>	<u>Coefficient</u>	<u>T Statistic</u>
1973 - 1977	ΔWAX	ΔDR	0.2214	0.8193
1973 - 1978	ΔWAX	ΔDR	1.1565	4.1227
1973 - 1975	ΔWAX	ΔDR	0.2830	0.8734
1974 - 1976	ΔWAX	ΔDR	0.1724	0.6168
1975 - 1977	ΔWAX	ΔDR	-0.1433	-0.4935
1976 - 1978	ΔWAX	ΔDR	2.0441	4.4510

WAX = Weighted-average dollar exchange value
DR = Discount rate

Since on at least three occasions in 1978 -- January 6, August 18, and November 1 -- discount rate changes were made for international purposes, the above results seem reasonable. On each of these three occasions, however, more than a discount rate change occurred. In January, the Treasury announced its intention to actively support the dollar. In August, a meeting of the President's advisors on the international situation was announced, and the public was assured of the Administration's active concern. In November, a \$30 billion equivalent support package was announced. In order to insure that the regressions were estimating the effects of discount rate changes and not packages, the equations for 1973 to 1978 and 1976 to 1978 were re-estimated with a dummy "package" variable for the three discount rate changes mentioned above.

Tables 5A and 5B show the results of the regressions with the addition of a dummy variable. The significance of the discount rate variable is reduced but not eliminated, except in the segmented cases where it is marginally insignificant at the .05 level and significant at the .10 level. Changes in the coefficients seem to indicate that most, but not all, of the announcement effects in 1978 were package announcement effects and not just discount rate announcement effects.

Since the November 1 dollar support package had such a substantial impact on the dollar's exchange value, and included the largest discount rate change in the sample period, regressions comparable to those presented in Tables 4 and 5 were performed on data from January 2, 1973 only through October 20, 1978. The results in Table 6 give mixed evidence that all of the announcement effects which occurred in the sample period occurred around November 1. Since the inclusion of the dummy "package" variable leaves the discount rate variable

Table 5A
 COMPARISON OF REGRESSION RESULTS
 WITH AND WITHOUT DUMMY "PACKAGE" VARIABLE
 January 2, 1973 to November 9, 1978
 (entire data arrays)

<u>Period</u>	<u>Equation</u>	<u>Dependent Variable</u>	<u>Independent Variable</u>	<u>Coefficient</u>	<u>T Statistic</u>
1973 - 1978	(1)	ΔWAX	ΔDR	1.1516	6.3686
1973 - 1978	(2)	ΔWAX	ΔDR	0.4979	2.3864
			DUMMY	1.6344	6.0683
1976 - 1978	(1)	ΔWAX	ΔDR	1.9660	9.1261
1976 - 1978	(2)	ΔWAX	ΔDR	0.8993	2.9359
			DUMMY	1.3668	4.8280

Table 5B
 COMPARISON OF REGRESSION RESULTS
 WITH AND WITHOUT DUMMY "PACKAGE" VARIABLE
 (segmented data arrays)

<u>Period</u>	<u>Equation</u>	<u>Dependent Variable</u>	<u>Independent Variable</u>	<u>Coefficient</u>	<u>T Statistic</u>
1973 - 1978	(1)	ΔWAX	ΔDR	1.1565	4.1227
1973 - 1978	(2)	ΔWAX	ΔDR	0.4932	1.5708
			DUMMY	1.6375	4.0652
1976 - 1978	(1)	ΔWAX	ΔDR	2.0441	4.4510
1976 - 1978	(2)	ΔWAX	ΔDR	0.9631	1.5293
			DUMMY	1.4079	2.4260

Equation 1: $\Delta WAX = a(\Delta DR) + b(\Delta TBR)$

Equation 2: $\Delta WAX = a(\Delta DR) + b(\Delta TBR) + c(DUMMY)$

WAX = Weighted-average dollar value

DR = Discount rate

TBR = Treasury bill rate

Table 6A
REGRESSION RESULTS
January 2, 1973 to October 20, 1978
(entire data arrays)

<u>Period</u>	<u>Equation</u>	<u>Dependent Variable</u>	<u>Independent Variable</u>	<u>Coefficient</u>	<u>T Statistic</u>
1973 - 1978	(1)	ΔWAX	ΔDR	0.3531	1.8253
1973 - 1978	(2)	ΔWAX	ΔDR	0.1817	0.8798
			DUMMY	0.6858	2.3484
1976 - 1978	(1)	ΔWAX	ΔDR	0.4431	1.8013
1976 - 1978	(2)	ΔWAX	ΔDR	-0.0794	-0.2677
			DUMMY	0.8163	3.1153

Table 6B
REGRESSION RESULTS
(segmented data arrays)

<u>Period</u>	<u>Equation</u>	<u>Dependent Variable</u>	<u>Independent Variable</u>	<u>Coefficient</u>	<u>T Statistic</u>
1973 - 1978	(1)	ΔWAX	ΔDR	0.3465	1.2919
1973 - 1978	(2)	ΔWAX	ΔDR	0.1710	0.5994
			DUMMY	0.6911	1.7262
1976 - 1978	(1)	ΔWAX	ΔDR	0.4414	0.9127
1976 - 1978	(2)	ΔWAX	ΔDR	-0.0604	-0.1072
			DUMMY	0.8278	1.6757

insignificant, the results suggest that the announcement effects which occurred in 1978 excluding November were "package" announcement effects and not just discount rate announcement effects.

Conclusion

Changes in the U.S. discount rate generally do not generate announcement effects in the market for dollars because discount rate changes are largely explained by past movements in the Federal funds rate, and market participants therefore have sufficient information to anticipate such announcements. The work of Lombra and Torto gives evidence in support of this hypothesis for the period 1968 to 1974. This paper has provided similar evidence for the period 1973 to 1977. These results do not hold, however, when 1978 is added to the time series. The following factors appear to have worked, together or separately, to create a situation in which discount rate changes had announcement effects in the foreign exchange market: (1) the Federal Reserve, in changing the discount rate, at times led, rather than lagged, changes in the Federal funds rate; (2) the Federal Reserve at times changed the discount rate to an extent not expected by the market; (3) changes in the discount rate were at times accompanied by other shifts in policy which had important impacts on the market.

The November 1 dollar support package, which included the largest discount rate change in the sample period along with several other policy measures, weighs heavily in the results presented in this paper. There is some evidence, although not conclusive, that November 1 may have been the only incident of a discount rate announcement effect in the sample period.^{4/} Other announcement

^{4/} Since the initial draft of this paper, Douglas R. Mudd has published an article in the Federal Reserve Bank of St. Louis Review, April 1979, which makes a stronger case that November 1, 1978 was the only incident of announcement effects.

effects of lesser magnitude seem to have occurred in 1978, but there is evidence that they were associated with policy measure packages and not solely with changes in the discount rate.