Discount Rate Changes and the Foreign Exchange Market

DISCOUNT RATE CHANGES AND THE FOREIGN EXCHANGE MARKET

Dallas S. Batten & Daniel L. Thornton
Federal Reserve Bank of St. Louis
83-016

The views expressed are those of the authors and do not necessarily reflect the views of the Federal Reserve Bank of St. Louis or those of the Board of Governors of the Federal Reserve System. The authors thank, without implicating, Mike Bordo, Alec Chrystal, and Mack Ott for their comments on an earlier draft and Sarah Driver for her research assistance

Abstract

Changes in the discount rate can have an associated announcement effect on the foreign exchange value of the dollar only if these changes are not anticipated by the market. This paper provides evidence to support this contention. Specifically, discount rate changes made for reasons other than technical adjustments have not been anticipated fully and, consequently, their announcement has had a significant impact on the dollar's exchange rate. Furthermore, results are obtained that support the hypothesis that unanticipated discount rate changes alter the expectation of the rate of future inflation.

4868r
0062R
DB/DT:ca
9th draft
11-8-83

Discount Rate Changes and the Foreign Exchange Market

DALLAS S. BATTEN and DANIEL L. THORNTON

Recently, there has been a particular interest in the empirical analysis of the impact of unexpected changes in monetary policy upon market interest rates and exchange rates (e.g., Cornell (1982, 1983), Engel and Frenkel (1982), Mishkin (1982 a, b) and Urich and Wachtel (1981)). Since the discount rate charged by the Federal Reserve on short-term loans to depository institutions continues to be considered an important barometer of its intentions, discount rate changes may have significant effects on these variables. In particular, these changes may be construed as indicating a change in the Federal Reserve's current and future monetary policy stance. The purpose of this paper is to investigate the nature of the effect of discount rate changes on the foreign exchange value of the dollar and the extent to which these changes are unanticipated.

I. EXCHANGE RATES: AN ASSET MARKET VIEW

In essence, an exchange rate is the relative price of two assets and is determined in organized,

efficient markets in the same manner as are the prices of other assets (e.g., stocks or bonds). In such markets, equilibrium prices are the ones at which the market is willing to hold the total outstanding stocks of the assets being exchanged. Because these assets are durable, their current prices functions not only are the market's perception of current events, but also the market's expectation of future events, especially the expected future prices of these assets. Consequently, any information that leads the market to alter its expected future price of an asset is discounted into that asset's current price as well.[1/]

The fact that exchange rates are prices of assets implies that the above analysis applies to the determination of the current exchange rate as well. In this case, these assets are domestic money supplies. Consequently, the fundamental determinants of exchange rates include, inter alia, the factors that affect the demands for and the supplies of domestic monies. Obviously, then, the monetary policies followed by each central bank and the market's perception of the direction of future policy actions play an integral role in the determination of exchange rates.

These features of the asset market approach can

be summarized by the following reduced form model.[2/] Let the logarithm of the spot exchange rate (S) on day t be determined by

$$(1)\quad \ln S_t = (1-\alpha)\, Z_t + \alpha\, E_t(\ln S_{t+1} - \ln S_t),$$

where $E_t(\ln S_{t+1} - \ln S_t)$ is the expected percentage change in the exchange rate between t and t+1, based on information available on day t, and Z_t summarizes the influences of other factors day t (e.g., foreign and domestic money supplies, incomes, exports, imports, etc.). By repeated substitution, equation 1 can be rewritten as

$$(2)\quad \ln S_t = \frac{1-\alpha}{1+\alpha}\, Z_t + \sum_{j=1}^{\infty} \left(\frac{\alpha}{1+\alpha}\right)^j E_t(Z_{t+j}).$$

That is, the current exchange rate is a function of current variables plus an exponentially weighted average of their expected future values.

II. DISCOUNT RATE CHANGES AND EXCHANGE RATE MOVEMENTS

Given the asset market view of exchange rates, an announced discount rate change can have an immediately discernable impact on the current exchange rate only if it is unanticipated. That is, if the market expects a discount rate change, this expectation will be incorporated into the exchange rate and, consequently, no "announcement effect" --

an immediate and perceptible market response -- will occur on the day of the change. On the other hand, if the discount rate change signals an unanticipated change in current or future domestic monetary policy, the participants in the foreign exchange market will quickly assimilate this new information resulting in a concomitant movement of the exchange rate.

Cornell (1982, 1983) has offered two hypotheses concerning the impact of unanticipated money supply changes on the exchange rate that can be applied here.[3/] An unanticipated discount rate change, like an unanticipated money supply change, may lead market participants to change their expectations concerning future monetary policy. The nature of these expectations determines the sign of the impact of a discount rate change. In particular, an unexpected decrease in the discount rate may be interpreted as an easing of current monetary policy and, consequently, may generate expectations that the Federal Reserve will counteract this change with a tighter policy in the future.[4/] In the anticipation of future monetary restraint, the market would bid up current real interest rates which would lead to an appreciation of the foreign exchange value of the dollar. This hypothesis, then, characterizes short-run changes in nominal interest rates as being

exchange value of the U.S. dollar, FFR is the federal funds rate, DR is the discount rate and TBR is the 3-month Treasury bill rate.[6/] This sample period spans periods of both federal funds rate and nonborrowed reserve targeting by the Federal Reserve, as well as periods of both frequent and infrequent intervention by the Federal Reserve in foreign exchange markets.

The distributed lag of $\Delta \ln TWS$ was included to capture the effect of other factors, not explicitly included here, on the foreign exchange rate prior to the discount rate change. The distributed lag of the change in the difference between the federal funds rate and the discount rate was included to capture the effect of anticipated changes in the discount rate on the exchange rate. During a little more than half of the period analyzed the Federal Reserve maintained a fairly narrow spread between the discount rate and the federal funds rate. Thus, a narrowing or widening of the spread between these rates could be a signal that a change in the discount rate was imminent. Such anticipated changes in the discount rate would be reflected in the exchange rate prior to discount rate change. The distributed lag of changes in the 3-month Treasury bill rate was included to insure that discount rate

changes were not merely reflecting general interest rate movements. Finally, to insure that the length of the distributed lags would not overlap discount rate changes, the length of each distributed lag was chosen arbitrarily as the shortest period during which the discount rate did not change.

To provide a more thorough examination of the existence of announcement effects due to discount rate changes, the data were partitioned in four ways. First, many discount rate changes are made solely for technical reasons (i.e., to bring the discount rate into closer alignment with short-term market interest rates), and as such, do not represent changes in policy. To reflect this, the discount rate changes were partitioned into those made for technical reasons (ΔDRTECH) and those made to signal a change in Federal Reserve policy. Changes made to signal policy changes were partitioned further into those motivated by domestic considerations (ΔDRDOM) and those motivated by international considerations (ΔDRINT).[7/]

Second, to examine hypotheses proffered by Brown (1979) and Mudd (1979) the data are partitioned (a) by separating the discount rate change on November 1, 1978 (ΔDRNOV78) from the others made for international reasons (ΔDROINT) and (b) by

dividing the data set into periods before and after December 31, 1977. In particular, Brown has hypothesized that discount rate changes from 1973 to 1977 were relatively predictable compared to those in 1978. Consequently, discount rate changes should have associated announcement effects only after 1977. Mudd carries this argument even further and proposes that, of the discount rate changes in 1978, only the one on November 1 should have had an announcement effect. (The reason for this expected effect is that this discount rate change was accompanied by statements by the U.S. Treasury and the Fed describing their intentions to intervene actively in foreign exchange markets to support the dollar.)

Third, the possible impact of U.S. intervention in foreign exchange markets is investigated by partitioning ΔDROINT into those discount rate changes made during periods when the United States actively intervened in those markets (ΔDROINV) and those made during the remainder of the sample period (ΔDRONINV). In particular, during most of the sample period the United States intervened in foreign exchange markets infrequently, leaving that activity primarily to foreign monetary authorities. With strong downward pressure on the dollar in 1978,

estimated coefficients of ΔDR (and its partitions) are the focus of this analysis, they are the only ones presented. Of interest among the unreported results, however, is the fact that neither the distributed lag of the logarithm of past exchange rate changes ($\Delta \ln TWS_{t-i}$) nor the distributed lag of past changes in the spread between the federal funds rate and the discount rate was statistically significant. The former result supports the idea that the exchange rate is a random walk; i.e., knowledge of past changes should provide no useful information about a change in the current exchange rate.[9/] The latter result (accompanied by the statistical significance of ΔDR) indicates that, on average, changes in the FFR/DR spread did not provide sufficient information for the market to anticipate fully the discount rate change. Furthermore, excluding the FFR/DR spread from the estimation had no quantitative or qualitative impact on the coefficients of ΔDR and those of its partitions.

In each of the equations reported, there is evidence of an announcement effect associated with a discount rate change. Moreover, this announcement effect is positive, providing support for the inflationary expectations hypothesis. For example, from table 1, Variant I, a 1 percentage point change

in the discount rate for whatever reason motivates a daily exchange rate change that is almost 0.7 of a percentage point higher than it would have been otherwise.[10/] When the discount rate change is partitioned by the reason given for the change, Variant II, only those made for international or domestic purposes are statistically significant with the impact of changes made for international reasons four times larger than that of changes made for domestic reasons. As expected, discount rate changes made as technical adjustments do not represent changes in Fed policy and hence, are fully anticipated. These changes have no associated announcement effect. The separation of the discount rate change on November 1, 1978 from the others made for international reasons, Variant III, reveals that the impact of the November 1, 1978 change was over 3-1/2 times larger than the average impact of other changes for international reasons. Finally, it appears that discount rate changes made for international purposes had announcement effects only if the Fed was also actively intervening in foreign exchange markets--Variant IV.

The hypothesis that discount rate changes occurring before 1978 were relatively predictable and, consequently, should have no associated

announcement effect is investigated in table 2. These results support this hypothesis. Six of the eight discount rate changes in period were made for technical reasons. Hence, one would not expect significant announcement effects during this period. Nevertheless, even the discount rate changes made for domestic purposes had no impact.

The possible impact of the Fed's change in operating procedure in October 1979 is examined in table 3. Consistent with the analysis over the entire sample period, discount rate changes made for international reasons had significant announcement effects in either sub-period while those made for technical reasons did not.[11/] Alternatively, announcements of discount rate changes made for domestic reasons have a significant impact only during the period of nonborrowed reserves targeting. That is, when the Fed was targeting on the federal funds rate, discount rate changes were apparently anticipated sufficiently so that their announcement had no significant impact on the exchange rate.

V. SUMMARY AND CONCLUSIONS

Discount rate changes can have an immediate and detectable impact on exchange rates only if their announcement is not completely anticipated by the

market. This paper has provided evidence to support this contention. In particular, discount rate changes that have been made for reasons other than a technical adjustment have not been anticipated fully and, as a result, their announcement has had both a statistically and an economically significant impact on the trade-weighted exchange value of the dollar. Furthermore, these results support the hypothesis that unanticipated discount rate changes motivate changes in the market's expectations concerning future inflation, not future real interest rates--a result consistent with those of Dwyer (1981) and Mishkin (1982b). Finally, it appears that discount rate changes made for international reasons had most of their impact during the period when the United States actively intervened in foreign exchange markets while the impact of those made for domestic policy reasons was significant only during the period of nonborrowed reserves targeting.

Footnotes

1/ For a more detailed discussion of the asset market view of exchange rate determination and the role of expectations, see Frenkel (1981) and Mussa (1979).

2/ This representation is similar to that presented in Frenkel (1981) and Frenkel and Mussa (1980). This reduced form representation can be derived from several structural models of exchange rate determination. While these models may differ in the composition of Z, they all share a common general view of exchange rate determination.

3/ In addition to the hypotheses considered here, Cornell (1983) offers two others--the real activity and the risk premium hypotheses.

4/ This so-called "policy anticipation effect" is attributed to Urich and Wachtel (1981).

5/ This hypothesized impact of a discount rate change on the exchange rate is observationally equivalent to the existence of a liquidity effect. That is, a fall in the discount rate, ceteris paribus, causes real interest rates to fall (at least in the short run) and, consequently, the exchange rate depreciates. This can only be a short-run phenomenon, however; expectations must change in one of the manners hypothesized above. Consequently,

following Cornell (1982) and Urich and Wachtel (1981), we have chosen to ignore this possibility in interpreting our results.

6/For a discussion of the construction of the weighted average exchange value of the U.S. dollar, see Board of Governors of the Federal Reserve System (1978). The contemporaneous term is excluded from the distributed lag of the change in the Treasury bill rate since this would also be affected by a discount rate change and hence, its inclusion would introduce an identification problem. (See Thornton (1982).)

7/Friedman (1959) recognized this dichotomization many years ago. Our ability to differentiate the reasons behind discount rate changes has been aided by the Fed giving their reasons when each discount rate change is announced. Of the 36 discount rate changes made during the period analyzed, 15 were made solely for technical reasons, 14 included domestic considerations and 7 included international policy considerations as reasons for the change.

8/For a more detailed discussion of this change, see Lang (1980).

9/This conclusion is supported by Frenkel (1981) and Mussa (1979). Furthermore, the relatively low $\bar{R}^2$s confirm the basic result of the asset market

approach--that is, that most of the variance of exchange rate movements is attributable to unexpected events.

10/ This result is of more than statistical significance as the average daily change in TWS during this period was 0.01 percent and the average absolute change was 0.3 percent.

11/ When the discount rate change on November 1, 1978, is separated from the others made for international policy reasons, each has a statistically significant, positive impact.

Table 1

Estimation of Variants of Equation 3:
1/2/75 - 3/3/83

	Variable	Estimated Coefficient	R^2/SE	F
I.	ΔDR	.0067*	.041	4.61*
		(6.18)	.0044	
II.	ΔDRINT	.0224*	.064	6.36*
		(8.86)	.0044	
	ΔDRDOM	.0056*		
		(3.60)		
	ΔDRTECH	.0002		
		(0.09)		
III.	ΔDRNOV78	.0441*	.080	7.56*
		(10.02)	.0043	
	ΔDROINT	.0119*		
		(3.90)		
	ΔDRDOM	.0057*		
		(3.67)		
	ΔDRTECH	.0001		
		(0.08)		
IV.	ΔDRNOV78	.0441*	.081	7.37*
		(10.03)	.0043	
	ΔDROINV	.0154*		
		(3.95)		
	ΔDRONINV	.0064		
		(1.31)		
	ΔDRDOM	.0057*		
		(3.68)		
	ΔDRTECH	.0002		
		(0.09)		

t-statistics in parentheses
* statistically significant at the 5 percent level
ΔDRINT = discount rate changes for international reasons
ΔDRDOM = discount rate changes for domestic reasons
ΔDRTECH = discount rate changes for technical reasons
ΔDRNOV78 = discount rate change on November 1, 1978
ΔDROINT = discount rate changes for international reasons other than that on November 1, 1978
ΔDROINV = discount rate changes for international reasons other than that on November 1, 1978 during activist intervention period
ΔDRONINV = discount rate changes for international reasons other than that on November 1, 1978 during the period of inactive intervention

Table 2

Estimation with Sample Period Broken at 12/31/77

Period	Variable	Estimated Coefficient	$\bar{R}^2$/SE	F
1/2/75 - 12/30/77	ΔDRDOM	.0054 (1.59)	.030 .0023	1.93*
	ΔDRTECH	.0001 (0.05)		
1/2/78 - 3/3/83	ΔDRINT	.0223* (7.37)	.064 .0052	4.40*
	ΔDRDOM	.0057* (2.93)		
	ΔDRTECH	.0002 (0.10)		

See notes to table 1.

Table 3

Estimation with Sample Period Broken at 10/6/79

Period	Variable	Estimated Coefficient	R^2/SE	F
1/2/75 - 10/5/79	ΔDRINT	.0257* (10.91)	.105 .0033	6.35*
	ΔDRDOM	.0045 (1.18)		
	ΔDRTECH	.0002 (0.09)		
10/9/79 - 3/3/83	ΔDRINT	.0160* (2.86)	.045 .0056	2.52*
	ΔDRDOM	.0056* (2.68)		
	ΔDRTECH	.0005 (0.17)		

See notes to table 1.

References

Board of Governors of the Federal Reserve System, "Index of the Weighted-Average Exchange Value of the U.S. Dollar: Revision," Federal Reserve Bulletin, August 1978, 64: 700.

Brown, K.H., "A Cross Country Study of the Relationship Between Discount Rate Changes and Exchange Rate Movements," Board of Governors of the Federal Reserve System International Finance Discussion Paper No. 169, November 1980.

Brown, K.H., "Impact of Changes in the Discount Rate on the Dollar's Foreign Exchange Value," Board of Governors of the Federal Reserve System International Finance Discussion Paper No. 144, June 1979.

Cornell, B., "Money Supply Announcements, Interest Rates, and Foreign Exchange," Journal of International Money and Finance, August 1982, 1: 201-208.

Cornell, B., "The Money Supply Announcement Puzzle: Review and Interpretation," The American Economic Review, September 1983, 83: 644-657.

Dwyer, G.P., "Are Expectations of Inflation Rational? Or Is Variation of the Expected Real Interest Rate Unpredictable?" Journal of Monetary Economics, July 1981, 8: 59-84.

Engel, C. and J.A. Frenkel, "Why Money Announcements Move Interest Rates: An Answer from the Foreign Exchange Market," NBER Working Paper No. 1049, December 1982.

Frenkel, J.A., "Flexible Exchange Rates, Prices, and the Role of 'News': Lessons from the 1970s," Journal of Political Economy, August 1981, 89: 665-705.

Frenkel, J.A. and M.L. Mussa, "The Efficiency of Foreign Exchange Markets and Measures of Turbulence," The American Economic Review, May 1980, 70: 374-381.

Friedman, M., A Program for Monetary Stability, New York: Fordham University Press, 1959.

Lang, R.W., "The FOMC in 1979: Introducing Reserve Targeting," Federal Reserve Bank of St. Louis Review, March 1980, 62: 2-25.

Mishkin, F.S., "Does Anticipated Monetary Policy Matter? An Econometric Investigation," Journal of Political Economy, February 1982a, 90: 22-51.

Mishkin, F.S., "Monetary Policy and Short-Term Interest Rates: An Efficient Markets-Rational Expectations Approach," The Journal of Finance, March 1982b, 37: 63-72.

Mudd, D.R., "Did Discount Rate Changes Affect the Foreign Exchange Value of the Dollar During 1978?" Federal Reserve Bank of St. Louis Review, April 1979, 61: 20-26.

Mussa, M.L., "Empirical Regularities in the Behavior of Exchange Rates and Theories of the Foreign Exchange Market," in K. Brunner and A. Meltzer, eds., Policies for Employment, Prices, and Exchange Rates, supplement to the Journal of Monetary Economies, Amsterdam: North Holland, 1979, 9-57.

Thornton, D.L., "The Discount Rate and Market Interest Rates: What's the Connection?" Federal Reserve Bank of St. Louis Review, June/July 1982, 64: 3-14.

Urich, T. and P. Wachtel, "Market Response to the Weekly Money Supply Announcements in the 1970s," The Journal of Finance, December 1981, 36: 1063-1072.