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Discount Rate Policies of Five Federal Reserve Chairmen

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ABSTRACT

This paper investigates the discount rate policies of five Federal Reserve chairmen: Martin, Burns, Miller, Volcker and Greenspan. Both in terms of the reasons given for making discount rate changes and the frequency of discount rate changes, the discount rate policies of Martin and Greenspan were very similar, as were those of Burns and Volcker. The discount rate policy of Chairman Miller differed from either of these groups. Measured by the money market's response to discount rate changes, the discount rate policy of Burns and Volcker was the most effective and Miller's the least effective. Evidence is presented that suggests that the differential response is due to the fact that the discount rate policy of Burns and Volcker provided the market with more complete information than that of Martin and Greenspan. The evidence also supports critics of the Federal Reserve's discount rate policy prior to the early 1960s.

JEL CLASSIFICATION: E40, E52

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"Discount policy – particularly with respect to changes in the discount rate – is a simple and easily understandable technique of informing the market of the monetary authorities' view on the economic and credit situation."--Charles Walker, "Discount Policy in Light of Recent Experience" ***Journal of Finance*** (May 1957), p. 229.

"The financial community thinks of the Reserve Bank discount rates as pivotal in the credit market . . . In light of this fact, it is only natural that the business and financial community should commonly interpret a change in the level of Reserve Banks' discount rates as an important indication of the trend in Federal Reserve policy."--Board of Governors of the Federal Reserve, ***The Federal Reserve System, Purposes and Functions*** (1963b), p. 45.

"No simple rules govern the interpretations of changes in the discount rate. In some circumstances a change in the discount rate may express a shift of Federal Reserve policy toward restraint or ease. In other instances, it may reflect a further step in the same direction. In still other cases, a change may represent merely a technical adjustment to market rates . . . "--Ralph Young, "Tools and Process of Monetary Policy," in ***United States Monetary Policy*** (1964), p. 44.

"...discount rate . . . 'announcement effects' are an additional source of uncertainty in the economy."--Milton Friedman, ***A Program For Monetary Stability*** (1960), p. 39.

The role of the Federal Reserve's discount rate has been controversial. Some [e.g., Simmons (1956)] argued that the discount rate was of little consequence for the supply of reserves because of the Fed's administration of the discount window. Others [e.g., Walker (1957)] thought discount rate policy to be an effective method of informing the market of the Fed's views on economic and credit conditions through a so-called *announcement effect*. Indeed, the Fed viewed announcements of discount rate changes to be an effective means of communicating its policy intentions. Critics [e.g., Friedman (1960), Smith (1956, 1958) and Young (1964)] argued that the discount rate is changed for a variety of reasons, including simply to bring the discount rate into better alignment with market interest rates. Hence, by failing to acknowledge the reasons for its action, critics argued that likely as not the Fed's intentions would be misconstrued. Succumbing to criticism, in the early 1960s the Fed began the practice of issuing a statement of intent along with its announcement of a discount rate change.

Research [e.g., Waud (1970), Froyen (1975), Mudd (1979), Brown (1981), Roley and Troll (1984), Hakkio and Pearce (1992) and Wagster (1993)] has shown that the financial, stock and foreign exchange markets respond significantly to discount rate changes. Moreover, Thornton (1982) and subsequent researchers [Smirlock and Yawitz (1985), Cook and Hahn (1988), Batten and Thornton (1984, 1985), Thornton (1986, 1994, 1995)] have shown that statements of intent are important for assessing the markets' reactions to discount rate changes. In particular, the financial and foreign exchange markets respond only to discount rate changes which the Fed announces are **nontechnical**, i.e., made for reasons other than simply to realign the discount rate to market rates. Some [e.g., Smirlock and Yawitz (1985) and Batten and Thornton (1984)] have conjectured that the markets do not respond to **technical** discount rate changes

because they are anticipated. The evidence [Thornton (1995)] does not support this interpretation, however. Rather the evidence suggests that the markets do not respond to technical discount rate changes simply because they provide the market with no relevant information.

The practice of issuing a statement of intent, which began under Chairman Martin, marks a fundamental change in discount rate policy. Furthermore, the way this statement has been used characterizes an important difference in the discount rate policies of Federal Reserve Chairmen. This paper examines the discount rate policies of the last five Federal Reserve Chairmen. The market's response to differences in the discount rate policies of these chairmen is investigated and analyzed.

I. *Discount Rate Policies of Five Fed Chairmen*

Starting in 1933, throughout World War II, and during most of the immediate post-War period discounting was virtually nonexistent. In the sixteen years from 1933 to 1949, discount and advances were below their level of the 1920s. Discount rate policy was also dormant. The discount rate was changed only once between February 1934 and December 1947.[1]

With the establishment of the Accord between the Federal Reserve and the Treasury, on March 3, 1951, discounting resumed an important role in monetary policy. Indeed, the Fed elevated discounting to the point of suggesting that open market operations would be

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[1]This statement is based on changes in the discount rate of the Federal Reserve Bank of New York. At this time, it was common for the 12 Federal Reserve Banks to have slightly different discount rates and to adjust them somewhat differently. The pattern of rate adjustments was similar for the other 11 Reserve Banks, however.

supplementary to it.[2] Initially, the Fed relied on what Roosa (1952, 1959) and others described as banks' *reluctance to borrow* from the central bank to regulate the level of borrowing. Borrowing increased significantly under nonprice rationing, however. By December 1952, discount window borrowing had increased to $ 1.6 billion – 7.6 percent of total reserves. Concerned about the level of borrowing and continual indebtedness of some institutions, the Fed undertook a comprehensive reexamination of discounting in 1953, and discount rate policy reemerged.[3] The discount rate, which was changed only once between March 1951 and December 1953, was changed ten times between February 1954 and December 1957.

This study begins with the revival of the use of the discount mechanism as a tool of monetary policy and, in particular, with the revival of discount rate policy. It spans the period from January 4, 1954 to January 20, 1995, covering all or parts of the terms of five Federal Reserve chairmen, Martin, Burns, Miller, Volcker and Greenspan. Prior to the early 1960s, the Fed simply announced when Reserve Banks changed their discount rate. No reasons were given for the change. Beginning in the early 1960s, the Fed's announcement included a statement of intent, stating why the action was taken.[4]

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[2]In its Annual Report in 1952, the Board of Governors stated that "...the System contemplated that principal reliance for additional Federal Reserve credit, to support increased bank loans and investments, would be placed on member bank borrowing from Federal Reserves Banks and that open market operations would be limited as much as possible to supplying such additional demands as might be necessary to avoid undue restraint." Board of Governors of the Federal Reserve (1952), p. 91.

[3]See Ahearn (1963) for a discussion of the revived use of the discount rate during this period.

[4]It appears this change in policy occurred with the discount rate change made on July 16, 1963. The Board of Governors no longer has a copy of the press release for this discount rate change. According to the announcement in the *Federal Reserve Bulletin*, this change was

Thornton (1982) classified discount rate changes by these statements. Discount rate changes were considered *technical* if the action was taken solely to bring the discount rate into alignment with market rates and *nontechnical* otherwise. Subsequently, Cook and Hahn (1988) and Thornton (1995) partitioned nontechnical discount rate changes by their information content. This paper follows the taxonomy of Thornton (1995). Discount rate changes that are made solely to realign the discount rate are called **technical** changes [ΔDR_T], those that are made for this and other reasons are called **mixed** changes [ΔDR_M] and those made solely for other, policy reasons are called **policy** changes [ΔDR_P]. Finally, discount rate changes made prior to the change in discount rate policy are called **information deficit** changes [ΔDR_{ID}], to reflect the criticism of Friedman, Smith, Young and others that such discount rate changes were difficult to interpret because they contained no specific information.

Table 1 summarizes the discount rate changes made under the five Federal Reserve Chairmen. After the Fed, under Chairman Martin, began releasing statements of intent, all Fed Chairmen have followed this practice. The only exception was the 25 basis-point reduction in the discount rate made under Chairman Burns on December 16, 1971.

These data reveal some marked differences in the discount rate policies of the five chairmen. For example, Chairmen Martin and Greenspan never adjusted the discount rate solely to bring it into better alignment with market rates. Furthermore, only three of the ten nontechnical discount rate changes under Martin were made in part for technical reasons. Fewer than half of the nontechnical changes under Greenspan were mixed.

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nontechnical and is so classified here. The press release for the next discount rate change, made on November 23, 1964, is available and the reason for the change is stated.

In contrast, more than half of the discount rate changes under Burns and Volcker were made solely to realign the administered rate. Indeed, the first five discount rate changes under Burns were technical. Furthermore, about two-thirds of the nontechnical changes made under these chairmen were mixed. In contrast, more than half of Greenspan's changes and nearly three fourths of Martin's changes (following the change in discount rate policy) were made solely for policy reasons.

The table also shows a marked difference in the frequency of discount rate changes made by these chairmen. Miller is without peers. In just 17 months, Miller changed the discount rate seven times. In contrast, Martin and Greenspan adjusted the discount rate infrequently. Martin changed the discount rate just 30 times in the 193 months of his term covered by our sample. Greenspan changed the discount rate slightly less frequently, making just 13 changes in the first 90 months of his term. Burns and Volcker changed the discount rate about twice as often as Martin and Greenspan, changing the discount rate 26 and 28 times, respectively, in the 96 months of their terms.

In terms of both the type of change and the frequency of change the discount rate policies of Burns and Volcker are quite similar, as are the discount rate policies of Martin and Greenspan. The discount rate policies of both of these pairings of chairmen differed dramatically from that of Miller.

II. *The Market's Reaction to Discount Rate Changes*

This sample contains six technical discount rate changes, 11 nontechnical changes and 21 information-deficit changes that are not included in previous work. Consequently, before investigating whether differences in the discount rate policies resulted in differences in the money

market's reaction to discount rate changes, it is important to test the robustness of several results previously established in the literature and to investigate the market's reaction to information-deficient discount rate changes. Consequently, the equation

$$\Delta i_t = \alpha_0 + \beta(L)\Delta i_{t-1} + \alpha_1 \Delta DR_T + \alpha_2 \Delta DR_M + \alpha_3 \Delta DR_P + \alpha_4 \Delta DR_{ID} + \epsilon_t , \qquad (1)$$

was estimated. Δi_t denotes the t^{th} observation on either the change in the federal funds rate (ΔFFR) or the 3-month T-bill rate (ΔTB3). The n^{th}-order polynomial in the lag operator, L, $\beta(L) = \beta_0 + \beta_1 L + \beta_2 L^2 + \ldots + \beta_n L^n$, is included in this and all subsequent regressions to control for the effects of past information on the interest rate, but is not reported.[5]

For the T-bill rate the period covered is January 4, 1954 to January 20, 1995. Due to the availability of data, the period is slightly shorter, July 1, 1954 to January 20, 1995, when the funds rate is the dependent variable. The shorter period has two fewer discount rate changes, both information-deficient changes.[6]

The federal funds market was very thin for much of the 1950s and 1960s.[7] There were extended periods where the daily change in the federal funds rate is identically zero.[8] The federal

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[5]The order of this distributed lag was 10. Thornton (1995) also included a distributed lag of the federal funds rate when the T-bill rate is the dependent variable, but since the results are unaffected by the distributed lag of the funds rate, it is not included here.

[6]The numbers of discount rate changes reported in the tables are for the longer sample.

[7]The Board of Governors (1959) reports that through much of the 1950s the average daily volume of federal funds trading was estimated to be only about 4 to 10 percent of required reserves. Nichols (1965) reports similar results, with peak funds trading relative to required reserves of less than 20 percent.

[8]This could also be due to the fact that the funds rate was initially reported in eighths. It may also be the case that the reported basis for the rate changed at some point. See Nichols'

funds rate began to take on the characteristics of a fully functioning market only by the early 1970s.[9] Some of the unusual results reported for the funds rate below undoubtedly reflect this feature of these data.[10]

The change in the discount rate is the percentage-point change on the day that a discount rate change was first announced. The federal funds rate is a weighted average of rates on daily transactions for a group of federal funds brokers and is compiled by the Federal Reserve Bank of New York. The Treasury rate is taken at "market close," about 4:00 p.m. E.S.T. Changes in the discount rate are aligned with changes in market interest rates so that the change in the relevant rate can reflect announcements of discount rate changes.[11]

Estimates of Equation 1 using daily data are presented in Table 2.[12] They confirm two

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(1965) discussion of the federal funds rate. We were unable to confirm this possibility, however. The Board of Governors maintains that the rate has always been calculated as a weighted average of transactions for a group of brokers. The number of brokers used to calculate the rate has changed over time, however.

[9]By this time, there were relatively few days where the funds rate did not change by at least a few basis points and rate movements were no longer in multiples of eighths.

[10]The marked differences in the response of the federal funds and T-bill rate that is sometimes reported here is not characteristic of the rest of this literature, most of which included data since the early 1970s

[11]This was done by examining the official press release announcing discount rate changes. All but 19 of the releases had the precise time of the release. In these 19 cases, it was assumed the practice of announcing the discount rate action just after the market closed was followed.

[12] This and all other equations were adjusted for heteroskedasticity using a two-step GLS procedure. The equations were initially estimated with ordinary least squares (OLS). Estimates of the residuals form the OLS were partitioned into different periods and separate estimates of the standard errors for each period were made. The data were then transformed with the usual square-root transformation and OLS was reapplied to the transformed data. See the addendum to Table 2 for more details.

important results in the literature; markets do not respond to technical discount rate changes and the markets respond equally to mixed and pure policy discount rate changes. The estimated responses to these two types of discount rate changes are very similar for TB3 and are not significantly different for either rate. In addition, Table 2 reveals that the market responds to information-deficient discount rate changes, and the reaction is quantitatively similar to that of mixed and policy discount rate changes.

It is important to test the robustness of the results for information-deficient discount rate changes for two reasons. First, it is possible to get a statistically significant coefficient with only a few significant responses on particular days.[13] Second, Friedman, Smith and Young argued that by failing to state the reasons for their actions, the Fed's intent in changing the discount rate could be misconstrued. Since the Fed has acknowledged that some of these discount rate changes were purely technical in nature, "designed merely to keep the discount rates in line with market rates," evidence that the markets responded consistently to information-deficient discount rate changes would suggest that the Fed's critics were correct.[14]

The robustness of the result for information-deficient discount rate changes was investigated by partitioning ΔDR_{ID} into two groups, A and B. Group A has the first N discount rate changes; group B has the rest. The equation is estimated and the null hypothesis that the coefficients for groups A and B are equal is tested. Discount rate changes are then added to group A and deleted from group B and the hypothesis of equality is again tested. This procedure

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[13]This led Smirlock and Yawitz (1985) to provide evidence for a specific interpretation of the market's failure to react to technical discount rate changes that is demonstrably incorrect. See Thornton (1995) for details.

[14]Board of Governors (1963a), p. 123.

was repeated, each time with more discount rate changes in group A and fewer in group B. Finally, information-deficient discount rate changes are partitioned into three groups, A, B, and C.

The results of these estimates and the test results are summarized in Table 3. The coefficient estimates vary considerably for the federal funds rate; however, generally they are significant at the 10 percent level. Moreover, the null hypothesis of equality is never rejected at the 5 percent level. The instability of the coefficient is likely due to the thinness of the federal funds market and the lack of day-to-day variation in the funds rate during this period. The results for the T-bill rate are robust. The coefficient estimates are quite stable and are always significant at the 5 percent level. Moreover, the null hypothesis of equality is never rejected at the 5 percent level.

The statistical significance of the market's response to information-deficient discount rate changes and, in particular, its robustness, suggests that the market consistently inferred something about the Fed's intentions based solely on its actions. The evidence suggests that, were it told that some of these discount rate changes were merely technical adjustments of the discount rate, the market would not have responded to these changes. Since no information was provided, the market appears to have inferred some greater significance than was intended to these "technical" discount rate changes.

A. *The Market's Reaction to The Discount Rate Policies of Five Fed Chairmen*

Since the market does not respond to them, technical discount rate changes are not considered in the remaining analyses. Also, since there is no basis for differentiating between mixed and policy discount rate changes and because of the small number of each type for each

chairman, mixed and policy discount rate changes are combined into nontechnical discount rate changes, [ΔDR_{NT}].

To investigate whether the market responded differently to discount rate policies of the five Fed chairmen, nontechnical discount rate changes are partitioned by the chairman under which they were made.[15] Information-deficient discount rate changes are included separately. Estimates of this equation are presented in Table 4.

The primary feature of these results is that differences in the response to the discount rate changes made under these chairmen are consistent with differences in their discount rate policies revealed in Table 1. The market's response to nontechnical discount rate changes under Burns and Volcker are very similar, as are their discount rate policies. The response to discount rate changes under these chairmen is quantitatively similar for both the federal funds and T-bill rate, and in neither case is the difference statistically significant.

A similar result is obtained for the T-bill rate for discount rate changes under Martin and Greenspan. The difference is significant at the 5 percent level, however. Interestingly enough, the funds rate did not respond significantly to the ten nontechnical changes under Martin. While problematic, this likely reflects the nature of the funds market and the funds rate data at the time.

In addition, consistent with observed differences in his discount rate policy, the response to nontechnical changes under Miller is different, and generally smaller, than that of the other

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[15]Some have conjectured that the response to discount rate changes might vary with the Fed's operating procedure, such as it change from federal funds rate to nonborrowed reserves targeting and back again. However, Thornton (1995) presents evidence that the response to discount rate changes is invariant to changes in the Fed's operating procedure.

chairmen. This is particularly true for the T-bill rate, where the response to discount rate changes under Miller is significantly different from the others, with the exception of Martin.

B. Why Does the Market Responds Differently to Alternative Discount Rate Policies?

These results suggest that the difference in the market's response is attributable to differences in discount rate policies. The discount rate policies of these chairmen differ by the reasons given for the action and the frequency of the action. Hence, the observed difference in the market's response must be tied to one or the other of these characteristics. For example, it might be that the relatively small response to discount rate changes under Miller is due to the fact that he changed the discount rate frequently. Like the response to the boy who cried wolf, the market turned a deaf ear to Miller's discount rate adjustments. The shortness of Miller's term, however, makes this interpretation somewhat unlikely. In any event, there are so few discount rate changes under Miller – apparently due solely to the shortness of his term – that it is virtually impossible to test this or any other hypothesis.

The discount rate policies of Martin and Greenspan and Burns and Volcker differ both in the frequency of the change and by the types of discount rate changes made. It seems more likely that differences in the market's response to the discount rate policies of these chairmen are to the types rather than frequency of discount rate changes. Much of the difference in the frequency of the change is due to the fact that Burns and Volcker indicated that some of their discount rate adjustments were made solely to realign the discount rate. If technical discount rate changes are ignored, the frequency of discount rate changes evens out considerably. Martin, Volcker, and Greenspan made nontechnical discount rate changes an average of 0.16, 0.18 and 0.14 times per

month, respectively, while Burns made nontechnical changes somewhat less frequently, an average of 0.10 times per month.

The discount rate policies of Martin and Greenspan and Burns and Volcker differ fundamentally in the amount of information they provide to the market. By stating that some discount rate changes are made solely to realign the rate, Burns and Volcker acknowledged what the market knows to be true – not all discount rate changes are made for policy reasons. Equally important, they enabled the market to identify discount rate changes that were made solely to realign the discount rate from other, policy changes.

By never acknowledging that some discount rate changes are made solely to realign the discount rate, Martin and Greenspan forced the market to sort things out on its own. In this respect, there is no difference between the discount rate policy of Martin and Greenspan and the discount rate policy of the Fed prior to its decision to issue a statement of intent. In both cases the market knew that some discount rate changes were made solely to realign the administered rate, but had no way to distinguish these discount rate changes from others.

In light of these differences in discount rate policies, the differential responses reported in Table 4 is not surprising. If the important information is whether a discount rate change is motivated by policy considerations, and if the market had difficulty distinguishing those which were motivated out of policy considerations from those intended solely to realign the discount rate (perhaps because of the tendency of all discount rate changes, regardless of type, to follow rather than lead the market [Thornton (1995)]), the response to nontechnical changes under Burns and Volcker should be larger than to nontechnical changes under Martin and Greenspan.

To illustrate this is so, let X_P denote the market's response to policy discount rate changes, X_T denotes the market's response to discount rate changes made solely to realign the discount rate and P denotes the probability of a policy discount rate change. Without information to distinguish between policy and realignment changes, the expected market response, χ, would be,

$$\chi = PX_P + (1-P)X_T .$$

The evidence suggests that $X_T = 0$, so that in the absence of information to distinguish between policy and other discount rate changes, $\chi = P\ X_P$. If the market is told which changes are made solely to realign the discount rate, however, then $P = 1$ and $\chi = X_P$.

By acknowledging when changes were made solely to realign the discount rate, Burns and Volcker provided the market with useful information. The market responds relatively more to discount rate changes which Burns and Volcker identified as nontechnical, because it has greater assurance that nontechnical changes are not made solely to realign the discount rate.

By not providing this information, the discount rate policies of Martin and Greenspan and Martin prior to the decision to release a statement of intent confounded the reaction of policy and technical discount rate changes. Unable to clearly distinguish those made solely as technical adjustments from others, the market infers some probability that every discount rate change is a technical adjustment.

If this hypothesis is correct, we might expect to find a differential response to mixed and policy discount rate changes under the discount rate policy of Burns and Volcker, but not under that of Martin and Greenspan. Because Burns and Volcker identified technical discount rate

changes, the market does not have to make this distinction. Consequently, when Burns and Volcker announced, as they infrequently did, that the discount rate was being adjusted solely for policy reasons, the market may have attributed somewhat more significance to these changes.

Martin and Greenspan not only did not help the market differentiate between technical and nontechnical changes, they attributed most of their nontechnical changes solely to policy considerations. This suggested something that the market almost certainly believed was untrue, namely, that discount rate changes were seldom made, even in part, to realign the discount rate. Hence, the market not only would have difficulty distinguishing between technical and nontechnical changes, but would have difficulty distinguishing between those motivated solely by policy and those which were not.

Also, the information content of discount rate announcements under Martin and Greenspan and Martin prior to the early 1960s was the same. Since the information content of these discount rate policies is qualitatively similar, so too should be the market's quantitative response. For this reason, not only should the market's response to mixed and policy changes under Martin and Greenspan be very similar, but they should be very similar to the response to information-deficient changes.

C. *Tests of the Discount Rate Policies of Burns and Volcker and Martin and Greenspan*

To test the hypothesis that differences in information account for differences in the market's reaction, Burns and Volcker [BV] nontechnical discount rate changes are partitioned into mixed and policy changes, as are those of Martin and Greenspan [MAG]. Estimates with nontechnical discount rate changes partitioned in this way and test results are reported in Table 5

[ΔDR_{ID} and Miller nontechnical discount rate changes, ΔDR_{NT}, are also included]. The results for the federal funds rate are again problematic and generally do not support the hypothesis. The response to mixed discount rate changes is larger than to policy changes. This is true for both MAG and BV; however, the differences are not statistically significant. The response to both types of discount rate changes under Martin and Greenspan is smaller than for Burns and Volcker and the differences are significant. In addition the response to information-deficient discount rate changes is larger than that of either mixed or policy changes under MAG, however, the differences are not significant.

The results for the T-bill rate are broadly consistent with the hypothesis. The response to policy changes under Burns and Volcker is about a third larger than the response to mixed changes. This difference is not significant at the 5 percent level, however, it is significant at the 10 percent level.[16] Hence, it appears that by clearly indicating when discount rate changes were made solely for technical reasons, Burns and Volcker gained some credibility when they announced that discount rate changes were made purely for policy reasons.

Likewise, as hypothesized, the response to MAG mixed and policy discount rate changes are nearly identical and nearly identical to the response to information-deficient discount rate changes and the null hypothesis of equality is not rejected. These results support the notion that

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[16]It should be noted, that the first discount rate change under Volcker was a policy change and was announced simultaneous with the Fed's announcement of a change in its operating procedure by focusing more attention on monetary aggregates and less on the federal funds rate. Consequently, this discount rate change provoked a very large reaction in market rates [see for example, Cook and Hahn (1988), Thornton (1982, 1995)]. Deleting this change from the BV policy changes has a relatively small effect on the coefficient, reducing it from 0.4827 to 0.4552, and virtually no effect on the response to mixed discount rate changes. However, the null hypothesis of equality of the response to mixed and policy discount rate changes is no longer rejected at the 10 percent level. The F-statistic is 1.9417.

never stating why a discount rate change is made is similar in information content to always stating that discount rate changes are made for policy related reasons. The market knows neither is accurate. Hence, in either case, it must attempt to sort out the truth on its own. Both discount rate policies provide the same information and, consequently, the same response.[17]

It is interesting to note that if the point estimate of ΔDR_P is taken to be the pure policy response, i.e., $X_P = 0.4827$, and the average point estimate of the responses to MAG and information-deficient changes in the discount rate are taken as the estimate of χ, i.e., $\chi = 0.2209$, the estimate of P, i.e., 0.2209/0.4827, is 0.458. This is nearly identical to the ratio of policy to the sum of policy and technical changes reported in Table 1, 0.463 [25/54]. These figures are remarkably similar and are consistent with the hypothesis that when uninformed, the markets infer some probability that the discount rate change was merely a technical realignment of the rate.

III. *Conclusions*

Prior to the early 1960s, the Federal Reserve simply announced changes in the discount rate without giving a reason for its action. Succumbing to pressure from critics [e.g., Friedman (1960), Smith (1956, 1958) and Young (1964)] the Fed, under chairman Martin, began stating the reasons for its actions. The reasons for discount rate changes and their frequency characterize fundamental differences in the discount rate policies. Using these criteria, the discount rate policies of the last five chairmen of the Federal Reserve were reviewed. We find that the discount

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[17]In an attempt to provide additional evidence, the equations reported in Table 5 were estimated by including the average spread between the federal funds and discount rate. If the market interpreted some discount rate changes as being partially technical, the response to discount rate changes get smaller as the spread gets larger. This variable was negative and statistically significant only for the T-bill rate. The coefficient was extremely small, however. Moreover, including this variable had no effect on the magnitude of the response to mixed and policy discount rate changes.

rate policies of Martin and Greenspan are essentially the same, as are the discount rate policies of Burns and Volcker. The discount rate policy of Miller differs significantly from the others.

Consistent with the criticisms of Friedman, Smith and Young, we find that the market responded consistently to discount rate changes made prior to its decision to issue a statement of intent along with discount rate announcements. The facts that (1) the Fed has acknowledged that some of these discount rate changes were made solely to realign the discount rate, the market consistently fails to respond to discount rate changes that the Fed announces are made solely to realign the discount rate and the market consistently responded to information deficient discount rate changes implies that the intent of the Fed was sometimes misconstrued.

In addition, we find that the market responds differently to the discount rate changes made under these chairmen in a manner consistent with observed differences in their discount rate policies. That is, the response to the discount rate changes under Burns and Volcker are nearly identical, as are their discount rate policies. Likewise, the discount rate policies of Martin and Greenspan are very similar and so too is the response of the market to discount rate changes made under these chairmen. Also, just like his discount rate policy, the response to discount rate changes under Miller differs from the responses to those of the other chairmen. Hence, it appears that differences in the market's response to discount rate changes made under the different chairmen are due to identifiable differences in their discount rate policies – discount rate policy does make a difference!

The market's response to nontechnical discount rate changes was the largest under the discount rate policy of Burns and Volcker. We hypothesize that the difference in the market's response to the discount rate policy of Burns and Volcker is due to the fact that they provided the

market with more information. In particular, by indicating which discount rate changes were made solely to realign the discount rate and which were not, Burns and Volcker spared the market this task. In contrast, by their failure to acknowledge what the market knew to be true, namely, that some discount rate changes are made solely to realign the discount rate, the discount rate policy of Martin and Greenspan and the discount rate policy of Martin prior to the early 1960s forced the market to make this distinction on its own.

We hypothesized that differences in information under the different discount rate policies accounts for observed differences in the market's response to nontechnical discount rate changes under these policies. Specifically, we hypothesized that the market's response to policy changes under Burns and Volcker should be larger than to other nontechnical discount rate changes, while the response to policy and other nontechnical changes would be the same under the policy of Martin and Greenspan. Moreover, we argued that the response to policy and other nontechnical changes under Martin and Greenspan should be the same as the response to information deficient discount rate changes under the discount rate policy of Martin prior to the early 1960s. Evidence consistent with this hypothesis is presented.

The irony is that announcing discount rate changes that are made solely for technical reasons provide no information, so the market does not respond to discount rate changes which the Fed identifies as being made solely to realign the discount rate. Yet, failing to admit what the market knows to be true, i.e., that some discount rate changes are made solely to realign the discount rate, appears to confound the signal that discount rate changes are intended to communicate.

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Table 1: Summary of Discount Rate Changes by Chairman and Type: January 4, 1954 through January 20, 1995

Chairmen of the Federal Reserve						
Type	Martin	Burns	Miller	Volcker	Greenspan	Total
ΔDR_T	0	16	2	11	0	29
ΔDR_M	3	6	3	11	6	29
ΔDR_P	7	3	2	6	7	25
ΔDR_{ID}	20	1	0	0	0	21
Total	30	26	7	28	13	104
Term[1]	193	96	17	96	90	

1/ Term ≡ term of the chairman in months during the sample period.

Chairman	Term
William McChesney Martin	April 2, 1951 - January 31, 1970
Authur F. Burns	February 1, 1970 - January 31, 1978
G. William Miller	March 8, 1978 - August 6, 1979
Paul A. Volcker	August 6, 1979 - August 11, 1987
Alan Greenspan	August 11, 1987 - present

Table 2: Estimated Response to Discount Rate Changes by Type

Type/[Number]	ΔFFR	ΔTB3
Const.	-0.0122 (1.24)	0.0130 (1.33)
ΔDR_T [29]	0.0558 (0.56)	0.0596 (1.45)
ΔDR_M [29]	0.4685* (5.89)	0.2570* (10.83)
ΔDR_P [25]	0.3931* (5.33)	0.2272* (13.87)
ΔDR_{ID} [21]	0.5455* (4.11)	0.2146* (7.62)
Adj R^2	0.1165	0.0715
F[1]	0.4849	1.0690

1/ F-statistic for the null hypothesis that the response to ΔDR_M and ΔDR_P are equal.
Absolute value of t-statistics in parentheses.
*Indicates statistical significance at the 5% level.

Table 2, continued
This equation was estimated using a general procedure of adjusting for heteroscedasticity by grouping periods with different variances. Specifically, the model $y_i = X_i\beta + \epsilon_i$, i = 1, 2, . . . N, was estimated using ordinary least squares, OLS. It is assmumed that $E(\epsilon_i \epsilon_i') = \sigma_i^2 I$ for all i. The equation was then re-estimated using generalized least squares, i.e., $\tilde{\beta} = (X'\tilde{\Omega}^{-1}X)^{-1}X'\tilde{\Omega}^{-1}Y$, where, $\epsilon = (\epsilon_1, \epsilon_2, \epsilon_3, \ldots \epsilon_N)'$ and $E[\epsilon \epsilon'] = \Omega$, a diagonal matrix. For more details about this approach see Fomby, Hill and Johnson (1984, pp. 174-76). The data are partitioned as below and are the partitions are the same for all of the estimated equations. The estimated variances changed very little, from equation to equation. Consequently, only the estimated standard errors for the estimates in Table 2 are presented.

Estimated Standard Errors

ΔFFR		ΔTB3	
Period	Estimate	Period	Estimate
7/1/54-5/23/60	0.2109	1/4/53-1/24/58	0.0372
5/24/60-2/27/62	0.5396	1/25/58-9/15/61	0.0674
2/28/62-5/26/66	0.1846	9/16/61-5/26/66	0.0199
5/27/66-3/3/67	0.3792	5/27/66-7/25/73	0.0627
3/4/67-4/21/69	0.1924	7/26/73-7/3/75	0.1720
4/22/69-7/3/70	0.5586	7/4/75-9/10/79	0.0753
7/4/70-12/5/75	0.2388	9/11/79-11/29/82	0.2718
12/6/75-9/10/79	0.1110	11/30/82-8/6/90	0.0768
9/11/79-11/29/82	0.6425	8/7/90-1/20/95	0.0417
11/30/82-11/27/90	0.2156		
11/28/90-2/14/91	0.5960		
2/15/91-1/20/95	0.1879		
first and last day	1.3303		
wed and thur	0.5857		

Table 3: Tests For Robustness in Response to Information-Deficient Discount Rate Changes

Number [A, B]	ΔFFR			Number [A, B]	ΔTB3		
	A	B	C		A	B	C
[7,12]	0.4004 (1.38)	0.5840* (3.91)	--	[8, 13]	0.1578* (3.03)	0.2381* (7.12)	--
[10, 9]	0.4220* (2.05)	0.6336* (3.65)	--	[11, 10]	0.2352* (6.58)	0.1811* (3.97)	--
[13, 6]	0.3971* (2.41)	0.8148* (3.67)	--	[14, 7]	0.2214* (6.68)	0.1972* (3.71)	--
[6, 6, 7]	0.7619 (1.89)	0.3942 (1.96)	0.6383* (3.25)	[7, 7, 7]	0.2029* (3.65)	0.2316* (5.61)	0.1972* (3.71)
F-test [7, 12]	0.3173	--	--	F-test [8, 13]	1.6866	--	--
F-test [10, 9]	0.6186	--	--	F-test [11, 10]	0.8705	--	--
F-test [13, 6]	2.275	--	--	F-test [14, 7]	0.1491	--	--
F-test [6, 6, 7]	0.5382	--	--	F-test [7, 7, 7]	0.1598	--	--

Absolute value of t-statistics in parentheses.
*Indicates statistical significance at the 5% level

Table 4: Response to NonTechnical Discount Rate Changes By Chairman

Chairman/[number]	ΔFFR	ΔTB3
Const.	-0.0122 (1.24)	0.0134 (1.36)
ΔDR_{ID} [21]	0.5453* (4.10)	0.2146* (7.57)
Martin [10]	0.1770 (1.29)	0.1874* (9.13)
Burns [9]	0.6532* (4.44)	0.4597* (7.74)
Miller [5]	0.3586* (3.02)	0.1160* (2.10)
Volcker [17]	0.6666* (5.44)	0.3752* (7.45)
Greenspan [13]	0.3498* [3.64]	0.2524* (12.16)
Adj R^2	0.1170	0.0747
Null Hypothesis	F-statistics	
Martin=Greenspan	1.0636	4.9615*
Burns=Volcker	0.0049	1.1788
Miller=Martin	1.0013	1.4633
Miller=Burns	2.4316	17.9407*
Miller=Volcker	3.2644	12.0034*
Miller=Greenspan	0.0033	5.3204*
All are equal	2.6227*	8.2008*

Absolute value of t-statistics in parentheses.
*Indicates statistical significance at the 5% level.

Table 5: Estimates of ΔDR_M and ΔDR_P by Complementry Regimes

Type/[number]	ΔFFR	ΔTB3
Const.	-0.0121 (1.23)	0.0134 (1.36)
MAG ΔDR_M [9]	0.3699* (3.03)	0.2350* (8.70)
MAG ΔDR_P [14]	0.2390* (2.32)	0.2133* (12.27)
BV ΔDR_M [17]	0.7968* (5.37)	0.3467* (6.58)
BV ΔDR_P [9]	0.5717* (4.69)	0.4827* (8.61)
ΔDR_{ID} [21]	0.5453* (4.11)	0.2146* (7.57)
Miller ΔDR_{NT} [5]	0.3587* (3.01)	0.1161* (2.10)
$AdjR^2$	0.1172	0.0744
Null Hypothesis	F-Statistics	
MAG ΔDR_M=MAG ΔDR_P	0.6716	0.4592
BV ΔDR_M=BV ΔDR_P	1.3754	3.1266
MAG ΔDR_M=BV ΔDR_M	4.9357*	3.5599
MAG ΔDR_P=BV ΔDR_P	4.3534*	21.1003*
MAG ΔDR_M=ΔDR_P=ΔDR_{ID}	1.6687	0.2420

Absolute value of t-statistics in parentheses.
*Indicates statistical significance at the 5% level.