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FEDERAL RESERVE POLICY, INTEREST RATE VOLATILITY, AND THE U.S. CAPITAL RAISING MECHANISM

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Abstract

The evidence presented in this paper leads to three conclusions about possible effects on the U.S. long-term capital raising mechanism due to the sharp increase in interest rate volatility that has followed the Federal Reserve System's adoption of new monetary policy procedures in 1979. First, the increased volatility has probably led nonfinancial corporations to finance less of their external funds requirements at long term than they would otherwise have done. Second, the increased volatility has probably led underwriters of high grade corporate bonds to increase the spread of a typical new issue's yield over the prevailing market yield on comparable bonds already outstanding. Third, there is little firm basis (reported here, anyway) to conclude that the increased volatility in particular has affected investors' portfolio behavior in the bond market.

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FEDERAL RESERVE POLICY, INTEREST RATE VOLATILITY, AND THE U.S. CAPITAL RAISING MECHANISM

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The object of this paper is to examine in detail, on the basis of the experience of the U.S. financial markets under the Federal Reserve System's new monetary policy procedures announced on October 6, 1979, one potentially important effect on the nonfinancial economy due to the resulting increase in interest rate volatility -- in particular, the possibility that increased volatility has impaired the market mechanism for raising long-term business capital.

Interest rate volatility has been a controversial issue in central bank policy making for a long time. The ultimate objectives that central banks pursue almost always refer to nonfinancial aspects of economic activity and well-being, like price stability and economic growth. In carrying out policies designed to further these objectives, however, central banks typically operate exclusively in the financial markets. Their actions therefore affect interest rates directly and visibly. Whether to use this influence on interest rates to smooth out short-run fluctuations, or alternatively to implement actions focused solely on other objectives, and hence leave interest rates to vary freely with the pulse of market pressures, is the central question.

In the United States the evolution of the Federal Reserve System's monetary policy procedures during the last decade, including in particular the changes announced in October 1979, in effect reversed the attitude toward interest rate volatility that had marked the first half-century of American central banking. When the Congress first established the Federal Reserve System in 1913, acting in response to a history of financial market disorders that had periodically depressed business activity, it charged the new central bank "to provide an elastic currency" to accommodate the economy's financing needs. That prescription led the Federal Reserve, through most of its existence, to pursue a policy aimed at stabilizing interest rate movements. By 1970, however, the drawbacks of focusing monetary policy on nominal interest rates in an era of rapid and volatile price inflation had become apparent, and the Federal Reserve shifted to a policy framework based on targeted growth rates for selected monetary aggregates. The implementation of the monetary targets strategy during the 1970s led to some increase in short-run interest rate volatility. Still, volatility remained limited, in large part because the Federal Reserve used a short-term interest rate (the federal funds rate) as the instrument by which it sought to control the monetary aggregates.

On October 6, 1979, the Federal Reserve publicly reaffirmed its commitment to the monetary targets framework and also announced a new set of operating procedures that, in effect, amounted to using the quantity of nonborrowed bank reserves as the instrument for controlling the monetary aggregates. As almost any theory of monetary policy would have predicted, the short-run volatility of short-term interest rates increased immediately and sharply. In addition, the short-run volatility of long-term interest rates increased as well. The amplitude of interest rate swings during the one-and-a-half business cycles that have occurred since October 1979 has been unprecedented in U.S. financial experience. Moreover, the volatility of interest rates over shorter time horizons — month-to-month, day-to-day, and even within the trading day — has also increased dramatically.

From a public policy perspective, however, the question is: so what? Why does interest rate volatility matter? Are whatever effects it may have quantitatively important? Does increased interest rate volatility constitute a significant drawback, possibly even one that may warrant discarding an otherwise useful way of conducting monetary policy?

To date economists and other commentators on monetary policy procedures have provided little serious analysis of the effects of interest rate volatility. Quantitative studies of the subject before October 1979 typically just tried to estimate how much interest rate volatility would follow from adopting one monetary policy framework or another, without going on to say anything about what would happen as a result of that volatility. Today, after more than two years of experience under the Federal Reserve's new procedures, the amount of volatility is readily observable but the question of its consequences still remains largely unexplored in any systematic way.[1] Moreover, even the informal discussions of the increased interest rate volatility since October 1979 have usually focused on its consequences strictly within the financial markets. In the final analysis, however, purely financial effects without any nonfinancial counterpart hardly constitute grounds for choosing one monetary policy framework over another.

On occasions when discussions of interest rate volatility have addressed the crucial question of effects on the nonfinancial economy, perhaps the most familiar idea to be raised is the possibility that increased volatility may impair the market mechanism for raising long-term capital for business fixed investment. If true, that would be a very important effect indeed. The U.S. economy's capital markets are unique in their ability to provide borrowers with long-term funds. The nonfinancial corporate business sector in particular relies heavily on external funds to finance its investment in new plant and equipment, and historically the great bulk of such external funds have come from borrowing at long term. Especially now that increased physical capital formation to spur the U.S. economy's productivity and international competitiveness has become a widely accepted goal of public policy, any significant erosion of the market system's ability to provide the requisite financial capital would present cause for serious concern. Although impairment of the capital raising mechanism is by no means the only possible effect of increased interest rate volatility, it is surely among the most important.

Exploring the effects of increased interest rate volatility on the long-term capital raising mechanism is the primary objective of this paper. Hence this analysis too deals with effects strictly within the financial markets.[2] What would ultimately matter for the determination of policy in this context, of course, is the further implication of any change in the capital raising mechanism on fixed capital formation. In principle it would be possible to undertake a direct analysis of the effects of increased volatility on actual physical investment and other aspects of nonfinancial economic activity. Nevertheless, the accumulated experience since October 1979 is still too brief in comparison to the time lags involved, and too many relevant factors have undergone substantial change during these few years, to warrant confidence in an analysis relating the post-1979 movement in fixed investment behavior to the increase in interest rate volatility. Instead, the compromise sought here is to focus on the long-term capital raising mechanism, thereby coming as close as possible to physical capital formation decisions while still limiting the analysis to phenomena observed within the financial markets.

Section I seeks to determine whether U.S. nonfinancial business corporations have raised less of their external funds in the form of long-term debt as a result of the increased interest rate volatility since October 1979. Because business conditions have hardly been "normal" during 1980 and 1981, simply comparing the bond share of total financing in these years with the average bond share in prior years is of little value. The operational question, instead, is whether a well developed model of corporations' bond financing that explains the data satisfactorily before October 1979 fails to do so thereafter. The specific model used here to address this question relates corporations' long-term borrowing, for a given external deficit to be financed, to a combination of portfolio substitution and expectation effects based on the prevailing pattern of interest rates on alternative financing strategies.

Section II takes as given the amount of long-term corporate borrowing done since October 1979 and seeks to determine whether the financial markets have made corporations pay more for the underwriting and initial distribution of this debt. The most obvious measure of new issue costs for publicly offered debt, the spread between the yields at which investment banking syndicates buy new securities from issuers and sell them to investors, has remained essentially fixed for many years on issues priced by negotiation and usually varies for largely independent reasons on issues priced by competitive bidding. Another important element of new issue costs, however, is the spread between the yield at which investors initially buy new securities and the currently prevailing yield on comparable securities already outstanding. This element of the interest rate on new issues is also a genuine cost of borrowing to the corporation, and at times it is a larger cost than that due to the underwriting spread. Using data on five different categories of long-term corporate bond issues, the analysis here compares the average values of this spread before and after the 1979 increase in interest rate volatility.

Section III again takes as given the amount of long-term corporate borrowing and seeks to determine whether the pattern of distribution of this debt has changed since October 1979. One consequence of the increased interest rate volatility frequently alleged by market participants is that the U.S. long-term bond market has become a vehicle more for "speculation" than for "investment." Although several possible operational renderings of that proposition lie beyond the scope of this paper, it is straightforward to determine whether specific classes of investors -- for example, life insurance companies, or private pension funds, or individuals -- have played a greater or lesser role in long-term lending than in prior years. To the extent that these classes of investors typically exhibit portfolio behavior which is more homogeneous within classes than across classes, such shifts in the distribution of bond holdings also signify changes in the behavior of the overall market.

Section IV briefly summarizes the paper's empirical findings and re-emphasizes some important caveats.

I. Effects of Volatility on the Volume of Long-Term Corporate Financing

In considering ways in which the recent increase in interest rate volatility may have effected the U.S. financial markets, and the implications that any such effects may have for choosing a monetary policy framework, it is best to start from the fundamentals. Despite the life of their own that financial markets seem to lead, the basic role of the financial markets in any economy is to facilitate nonfinancial economic activity. In an advanced economy like that of the United States, one of the most important specific ways in which the financial markets serve this function is by coordinating the independent actions of real savers and real investors that together determine the economy's physical capital formation.

One of the most widely recognized priorities in American economic policy today is the need to increase the nation's capital formation. Although economists and others continue to debate the reasons underlying the slowdown in U.S. productivity growth during the 1970s, there is broad agreement that additional investment in plant and equipment would contribute to a recovery of productivity growth -- and hence growth of the nation's standard of living -- in the future. Meanwhile, however, the capital formation rate has been not rising but falling. After a sharp increase in the 1960s attributable to specific investment incentives legislated early in the decade, investment in business plant and equipment (net of replacement for depreciation and obsolescence) declined from 4.0% of the gross national product on average during 1966-70 to 2.8% on average during 1976-80. Reversing this decline has become a major priority of public policy.

Financial markets are relevant to this objective because every physical investment decision has its financial counterpart. More to the point, the financial transactions associated with physical capital formation are not merely a reflection of real resource allocations that would necessarily come about in any case. The setting in which the financing of capital formation takes place can also importantly affect the allocation of real resources, including the total amount of capital formation as well as its composition. If increased interest rate volatility were to impair the market mechanism for financing capital formation, in the end it would restrict the economy's ability to undertake capital formation too.

Because corporations in nonfinancial lines of business regularly account for nearly three-quarters of all plant and equipment investment in the United States, it makes sense to focus the analysis on the economy's nonfinancial corporate sector. U.S. nonfinancial corporations typically rely heavily on external funds from the markets to finance their capital expenditures. External funds constituted 45.5% of total sources of funds for these firms, on average during the decade ending in 1980. Given U.S. corporations' traditional reluctance to raise equity capital except by retaining earnings, most of the external funds raised are usually in debt form (92.2% during 1971-80). Moreover, given the risk-averse preference for using obligations of longer maturity to finance investment in long-lived facilities, most of this debt has taken the form of bonds, mortgages, or other long-term instruments. Despite the much discussed increase in reliance on short-term debt in the 1970s, net new issues of long-term obligations accounted for an average 72.4% of all credit market borrowing by U.S. nonfinancial corporations during 1971-80, and long-term obligations constituted 72.2% of these corporations' total debt outstanding as of yearend 1980.

Has this pattern changed significantly since the Federal Reserve System implemented its new policy procedures? A simple inspection of financing data reveals that business reliance on short-term debt has indeed been high since

October 1979. Concluding that something fundamental has changed is a more subtle matter, however. To begin, only two years of experience does not constitute much of a laboratory for judging changes in economic behavior. Further, the pattern of the business cycle and of interest rate movements (wholly apart from short-run volatility) has been extraordinary during these years. Any judgment that a change in corporate financing behavior has occurred, which may have resulted from increased interest rate volatility, must therefore rely on a model that takes account of as many key factors as possible other than the increased volatility.

The model of nonfinancial corporations' long-term borrowing developed in Friedman [7] combines the familiar linear homogeneous model of portfolio allocation, applied to the selection of desired liabilities to finance externally a given cumulated deficit,

$$\lambda^*_{it} \equiv \frac{L^*_{it}}{D_t} = \sum_k^N \beta_{ik} r^e_{kt} + \pi_i, \; i = 1, \ldots, N \tag{1}$$

with the optimal marginal adjustment model of portfolio adjustment in the presence of transactions costs,

$$\Delta L_{it} = \sum_k^N \theta_{ik}(\lambda^*_{kt} D_{t-1} - L_{k,t-1}) + \lambda^*_{it} \Delta D_t, \; i = 1, \ldots, N \tag{2}$$

where L^*_i is the corporation's desired amount of the i-th liability outstanding ($\sum_i L^*_i = D$); D is the corporation's total cumulated external deficit, and ΔD its flow change; r^e_k is the expected "borrowing period" yield on the k-th liability; L_i is the corporation's actual amount of, and ΔL_i the change in, the i-th liability outstanding ($\sum_i L_i = D$, $\sum_i \Delta L_i = \Delta D$); subscript t indicates each particular time period; and the β_{ik}, π_i and θ_{ik} are fixed coefficients that satisfy $\sum_i \beta_{ik} = 0$ for all k, $\sum_i \pi_i = 1$, and $\sum_i \theta_{ik} = \bar{\theta}$ for all k, with $\bar{\theta}$ arbitrary.

The primary rationale motivating the use of the linear homogeneous portfolio selection model is, as usual, its convenience and tractability. In a single-period context, the assumption of constant relative risk aversion and joint normally distributed yield assessments is sufficient to render the linear homogeneous model optimal.[3] Some adjustment model is then necessary in a multi-period context in the presence of transactions costs. The principal advantage of the optimal marginal adjustment model for this purpose is that it represents, in a tractable way, the increased yield sensitivity of the allocation of the flow ΔD_t in comparison with the re-allocation of the stock D_{t-1}. This distinction is especially relevant when, as is the case in the United States, most long-term corporate liabilities are non-callable for at least some substantial time (typically five years for utility companies and ten years for other corporate borrowers) after the date of issue.[4]

Because of the non-callability of corporate bonds, the corporation's choice between long- and short-term financing at any time is more complex than a simple comparison of the prevailing yields on long- and short-term debt instruments. A decision not to finance at long-term leaves open the possibility of continually rolling over short-term debt, as well as the possibility of relying on short-term debt only temporarily and issuing long-term debt later on. At the least, therefore, the financing decision depends on the currently prevailing long-term yield, the expected average long-term yield in the future, and the expected average short-term yield currently and in the future.[5] Hence rewriting (1) for the specific case of long-term bonds gives (at a minimum)

$$\frac{B^*_t}{D_t} = \beta_{B1} r_{Bt} + \beta_{B2} r^e_{Bt} + \beta_{B3} r^e_{St} + \pi_B \qquad (3)$$

where B* is the corporation's desired amount of bonds outstanding, r_B is the currently prevailing yield on new issues of the corporation's bonds, r_B^e is the corporation's expectation of the average future value of r_B, and r_{St}^e is the corporation's expectation of the average current and future yield on its short-term securities.

Combining (3) with the relevant component of (2) then gives, as a specific expression for the corporation's net new issues of long-term bonds,

$$\begin{aligned}\Delta B_t = {} & \pi_B \cdot \Delta D_t + [\sum_k (\pi_k \cdot \theta_{Bk})] \cdot D_{t-1} \\ & + \beta_{B1} \cdot r_{Bt} \cdot \Delta D_t + [\sum_k (\beta_{k1} \cdot \theta_{Bk})] \cdot r_{Bt} \cdot D_{t-1} \\ & + \beta_{B2} \cdot r_{Bt}^e \cdot \Delta D_t + [\sum_k (\beta_{k2} \cdot \theta_{Bk})] \cdot r_{Bt}^e \cdot D_{t-1} \\ & + \beta_{B3} \cdot r_{St}^e \cdot \Delta D_t + [\sum_k (\beta_{k3} \cdot \theta_{Bk})] \cdot r_{St}^e \cdot D_{t-1} \\ & - \theta_{BB} \cdot B_{t-1} - \sum_{k \neq B} \theta_{Bk} \cdot L_{k,t-1} \end{aligned} \qquad (4)$$

where B is the amount of, and ΔB the change in, bonds outstanding. The optimal financing model implies $\beta_{B1} < 0 < \beta_{B2}, \beta_{B3}$. The optimal adjustment model implies $\theta_{BB} > 0$ (so that the coefficient on B_{t-1} is negative). Hence four of the model's coefficients have known signs a priori. The signs of π_B and the θ_{Bk}, $k \neq B$, are not known a priori, nor is the sign of any of the combinations shown within square brackets in (4) known a priori.

The result of estimating (4) for the aggregate net new issues of bonds by U.S. corporate businesses, using quarterly data for 1960:I - 1979:III and autoregressive proxies (described below) for the unobservable interest rate expectations, is

$$\begin{aligned}\Delta B_t = {} & \underset{(1.2)}{0.1809}\ \Delta D_t - \underset{(-6.2)}{1.653}\ r_{Bt} \cdot \Delta D_t + \underset{(6.0)}{1.533}\ r_{Bt}^e \cdot \Delta D_t \\ & + \underset{(3.0)}{0.1214}\ r_{St}^e \cdot \Delta D_t - \underset{(-0.7)}{0.00789}\ B_{-1} + \underset{(2.3)}{0.03245}\ S_{-1} \end{aligned}$$

$$\bar{R}^2 = 0.79 \qquad SE = 898 \qquad H = 1.72 \qquad (5)$$

where S is the nonfinancial corporate business sector's outstanding stock of short-term debt (including bank loans, commercial paper, finance company loans, and U.S. government loans), and the numbers in parentheses are t-statistics. $\bar{R}^2$ is the coefficient of determination adjusted for degrees of freedom, SE is the standard error of estimate (in millions of dollars per quarter), and H is Durbin's H-statistic. All four terms in (4) with coefficients consisting of sums of products of parameters in the underlying model are omitted in (5), since in each case there is no a priori expectation of a nonzero coefficient, and in each case preliminary experimentation did not indicate a value significantly different from zero at any reasonable level.[6] The expressions for the two interest rate expectations, generated within the estimation of (5), are[7]

$$r^e_{Bt} = r_{Bt} + \sum_{\tau=0}^{13} \gamma_\tau \Delta r_{B,t-\tau} \qquad \left(\sum_{\tau=0}^{13} \gamma_\tau = 1\right) \tag{6}$$

$\gamma_0 = 0.0576$ $\gamma_5 = 0.1264$ $\gamma_{10} = 0.0305$

$\gamma_1 = 0.0767$ $\gamma_6 = 0.1139$ $\gamma_{11} = 0.0124$

$\gamma_2 = 0.1086$ $\gamma_7 = 0.0958$ $\gamma_{12} = -0.0002$

$\gamma_3 = 0.1260$ $\gamma_8 = 0.0744$ $\gamma_{13} = -0.0051$

$\gamma_4 = 0.1312$ $\gamma_9 = 0.0519$

$$r^e_{St} = \sum_{\tau-1}^{18} \delta_\tau \, r_{S,t-\tau} \qquad \left(\sum_{\tau-1}^{18} \delta_\tau = 1\right) \tag{7}$$

$\delta_1 = -0.2608$ $\delta_7 = 0.0527$ $\delta_{13} = 0.1048$

$\delta_2 = 0.0842$ $\delta_8 = 0.0608$ $\delta_{14} = 0.1055$

$\delta_3 = 0.0641$ $\delta_9 = 0.0708$ $\delta_{15} = 0.1006$

$\delta_4 = 0.0522$ $\delta_{10} = 0.0815$ $\delta_{16} = 0.0888$

$\delta_5 = 0.0471$ $\delta_{11} = 0.0915$ $\delta_{17} = 0.0690$

$\delta_6 = 0.0477$ $\delta_{12} = 0.0997$ $\delta_{18} = 0.0398$

where the particular interest rates used for r_B and r_S are, respectively, the yield on new issues of long-term utility company bonds rated Aa by Moody's Investors Service, Inc., and the yield on prime 4-6 month commercial paper.

Apart from the slow adjustment speed indicated by the small (and insignificant) value for θ_{BB}, the estimated coefficients in (5) are all plausible in the context of the underlying theory of long-term borrowing behavior. The coefficients of the three yield terms in particular each have the expected respective sign and a satisfactory significance level. The equation fits reasonably well overall, and the H-statistic does not indicate significant serial correlation. Only four of the equation's 78 estimated residuals exceed two standard errors in absolute value, and none exceeds three standard errors.

If the relationship estimated in (5) represents nonfinancial business corporations' long-term borrowing behavior through September 1979, conditional on corporations' external deficit, their existing mix of long- and short-term debt outstanding, and the pattern of long- and short-term interest rate movements, has the corresponding experience since October 1979 (again, conditional on all of the same factors) indicated a significant change? Table 1 shows the out-of-sample prediction errors made by this equation for each of the seven quarters beginning in October 1979. The table also shows the estimated residuals for the last three quarters of the sample period, for purposes of immediate comparison.

The values presented in Table 1 show that the equation which describes nonfinancial corporations' borrowing behavior before October 1979 clearly fails to do so thereafter. In contrast to the absence of any within-sample residuals greater than three standard deviations, the out-of-sample prediction error is greater than three standard deviations in five of seven quarters.

TABLE 1

LONG-TERM BORROWING EQUATION PREDICTION ERRORS

	Actual Long-Term Borrowing	Predicted Long-Term Borrowing	Error	Multiple of Standard Error
In-Sample				
1979:I	5,500	4,190	1,310	1.5
1979:II	5,328	4,775	553	0.6
1979:III	4,841	6,475	-1,635	-1.8
Out-of-Sample				
1979:IV	5,490	6,285	-795	-0.9
1980:I	7,613	3,519	4,094	4.6
1980:II	10,021	9,380	643	0.7
1980:III	8,107	13,896	-5,789	-6.4
1980:IV	4,705	15,126	-10,431	-11.6
1981:I	7,118	11,009	-3,891	-4.3
1981:II	3,143	14,491	-11,348	-12.6

Notes: Values (except for multiple of standard error) are in millions of dollars.

Indeed, several of the prediction errors exceed the equation's standard error by absurd amounts.

In addition, the pattern of sustained under-prediction of long-term borrowing beginning at midyear 1980 also suggests that some factor representing a break from prior experience had come into play. Two specific aspects of this series of negative values bear comment. First, as is clear from the actual versus predicted values shown in the table, the problem is not the familiar story of data moving into a new range into which an equation, with its coefficients presumably biased toward zero, cannot follow. Instead, given the size of corporations' external deficits and the other explanatory variables, the equation predicts a sharp rise in long-term borrowing which (except for 1980:II) never materialized. Second, the series of large (in absolute value) residuals of the same sign stands in stark contrast to the within-sample pattern of nearly adjacent offsetting residuals. During the last three quarters of the sample, for example, the -1.8 standard deviation residual in 1979:III about offset the 1.5 standard deviation residual in 1979:I. Similarly, the only four in-sample residuals to exceed 2.0 standard deviations also occurred in a nearly adjacent and offsetting way (2.2 and -2.8 standard deviations in 1975:I and 1975:III, respectively, and -2.5 and 2.8 in 1977:II and 1977:IV respectively).[8]

At a more formal level, a Chow test for the null hypothesis that the equation's coefficients estimated over 1960:II - 1979:III remained unchanged when estimated over 1960:II - 1981:II produced an F-statistic of 6.10 -- far in excess of the 2.93 value needed to reject the null hypothesis at the 1% significance level. By contrast, the result of an analogous Chow test for stability of the equation's coefficients over the 1960:II - 1977:IV versus 1960:II - 1979:III samples (that is, deleting the last seven observations instead of adding seven more) did not warrant rejecting the null hypothesis, even at the more standard 5% level.

Because the β_{ik} coefficients in the underlying portfolio selection model (1) depend on the variance-covariance structure of the joint distribution of the associated yields, it is not surprising that a sharp increase in interest rate volatility like that which occurred after 1979:III would have led to instability in an estimated relationship like (5).[9] Indeed, the results in this regard go further than the Chow test's rejection of the joint stability of all of the model's coefficients. The results of estimating (4) over 1960:II - 1981:II, incorporating shift variables allowing the three β_{Bi} coefficients to assume different values during 1979:IV - 1981:II, indicated significant evidence of a shift in each of the three.[10]

It is also useful to distinguish the respective roles of coefficient shifts versus expectation proxy errors in accounting for the over-prediction of bond financing shown in Table 1.[11] The autoregressive proxy for long-term yield expectations (6) closely tracked movements in actual long-term yields throughout the post-sample period. By contrast, the autoregressive proxy for short-term yield expectations (7) was typically below the actual level of short-term yields during this period. Because the expectations that presumably matter for corporations' financing decisions are unobservable, these relationships do not necessarily indicate either success or failure of the autoregressive expectations proxies. To the extent that the low values generated by (7) do indicate a failure of the expectations proxy, however, given $\beta_{B3} > 0$ that failure is in the direction opposite to that needed to account for the over-prediction of long-term borrowing. On the basis of this limited evidence, therefore, the over-prediction does appear to be attributable to a shift in the portfolio behavior represented by (1), rather than to a failure of the autoregressive expectations proxies (6) and (7).

In sum, the evidence provided by an empirical model of nonfinancial business corporations' long-term borrowing behavior shows a significant break between the post October 1979 experience and the relationships that prevailed over the prior two decades. Moreover, since mid 1980 the change from prior behavior has been in the direction of less long-term borrowing than would previously have been consistent with corporations' overall borrowing requirements and other factors affecting the financing decision.

II. Effects of Volatility on the Costs of Corporate Financing

The evidence presented in Section I, which shows a shift away from long-term financing by U.S. nonfinancial business corporations, takes as given the prevailing level of short- and long-term interest rates. To the extent that that evidence indicates an effect of the post October 1979 increase in interest rate volatility on corporations' financing decisions, therefore, it abstracts from effects directly associated with interest rate levels. Such effects may be highly important, however. If the combination of borrowers' and lenders' reactions to increased volatility has been to raise the equilibrium level of long- relative to short-term interest rates, the model of corporate financing behavior in (5) indicates that over time corporations would finance less of a given external funds requirement at long term. Moreover, models of business plant and equipment investment in the tradition of Jorgenson [11] and Bischoff [1] indicate that over time an increase in long-term interest rates would also depress capital expenditures, so that there would be less external deficit to finance -- and less capital formation to contribute to the economy's productivity.

Because of the short time interval that has elapsed since October 1979, together with the extraordinary pattern of business cycle developments during this interval, it is simply too soon to draw a judgment about the extent (if any) to which the increase in interest rate volatility has altered fundamental relationships either among various interest rates or between interest rates collectively and expected price inflation. The swings in the slope of the maturity yield curve have been unprecedented during the past two-and-a-half years, but then so have the swings in interest rates themselves. On average, long-term rates have been somewhat below short-term rates, but such an "inverted" relationship is not unknown, especially at times of weak business activity. Just within the past year, both long- and short-term interest rates have been unusually high in comparison to observed current price inflation, but the conflicting cross-currents at work have prevented easy inferences about the more important expectations of future price inflation. Even if data were available to support a judgment that correctly inferred real interest rates were abnormally high, it would be impossible to have confidence in the attribution of this phenomenon to increased interest rate volatility.[12]

By contrast, one aspect of interest rate determination about which an inference of this kind may be plausible on the basis of the limited experience since October 1979 is the cost of long-term borrowing by corporations over and above the interest rate prevailing in the bond market at any given time. This cost is less fundamental in the sense of basic economic theory, but to the corporate borrower (or would-be borrower) it is no less real than any other component of the cost of borrowing. If a corporation must pay an additional 1% per annum to borrow, it does not much matter whether the increment reflects a higher equilibrium interest rate level, as in most theoretical models, or a higher cost of borrowing over and above the equilibrium level. The fact that most theoretical models assume away any market imperfections that could account for a cost above the equilibrium level is of no comfort.

The most obvious element of the difference between the interest rate paid by corporate borrowers and the prevailing market clearing rate is the "spread" between the yield (price) at which corporations sell new bond issues to underwriting syndicates and the yield (price) at which those syndicates in turn sell the bonds to investors. This spread is the syndicate members' compensation for managing, underwriting, and distributing the new securities.

What little variation in this spread has taken place, however, does not suggest any response to increased interest rate volatility. The spread on high grade long-term bonds priced by negotiation between the issuing corporation and the underwriting syndicate has remained essentially unchanged at $8.75 per $1,000 of par value for more than two decades, despite the presumed greater underwriting risk associated with increased interest rate volatility over many years. The spread on bonds priced by competitive bidding among rival underwriting syndicates (almost always issued by utility companies) is sometimes greater and sometimes smaller than $8.75; but its variation over tire primarily reflects the ever shifting competitive pressures within the investment banking industry, rather than any changes in specific external factors.

A second element of the difference between the interest rate paid by corporate borrowers and the prevailing market clearing rate, which has shown a sharp change since October 1979, is the spread between the yield (price) at which underwriting syndicates sell new bond issues to investors and the yield (price) at which comparable issues already outstanding are then trading. Although the spread between new issue and seasoned yields is less straightforward to analyze or even to measure than the underwriting spread, it is also a genuine cost of borrowing to the corporation, and at times it is a larger cost than that due to the underwriting spread.

Conard and Frankena [3], in their classic study of the new issue versus seasoned yield spread in the U.S. corporate bond market, hypothesized that one explanation for the existence of a positive spread is that it reduces underwriting risk. By pricing new securities at a discount in comparison to comparable securities already outstanding, underwriters can enhance prospects of rapid distribution of the new issue and therefore minimize the risks inherent in holding large amounts of the securities for several days or even weeks. The simultaneous existence of the underwriting spread and the new issue versus seasoned spread gives underwriters two tools with which to cope with a changing market environment. In response to an increase in underwriting risk associated with increased interest rate volatility, underwriters can either go ahead and assume the added risk and charge compensation for it by increasing the purchase versus sale spread, or else offset the added risk by increasing the new issue versus seasoned spread. Although neither Conard and Frankena nor Ederington [4] found clear cut evidence for such behavior, neither study's sample period (1952-63 and 1964-71, respectively) witnessed anything like the increase in interest rate volatility that has occurred since October 1979.[13]

The first three columns of Table 2 show the number of issues, and the mean and standard deviation of the same-day spread between each new issue's yield and Moody's comparable seasoned yield index, for five distinct categories of U.S. long-term corporate bond issues — first for the period including 1977, 1978 and 1979 through September, and then for the period including 1980 and 1981.[14] Although the standard deviations are large, indicating a substantial range of spreads, in four of the five categories the mean spread exhibited a sharp increase after October 1979. For each of the three categories of utility bonds (including telephone issues), the mean spread rose from zero or slightly negative to about 50 basis points, or 1/2% per annum. For Aa-rated industrials the mean spread rose from about zero to 1/8% per annum. Only in the case of A-rated industrials did the mean spread remain unchanged (at 1/8% per annum). For all five categories combined, the mean spread was -4 basis points before October 1979 and 38 basis points thereafter.

As is well known from the work of Conard and Frankena, unadjusted

TABLE 2

NEW ISSUE VERSUS SEASONED CORPORATE BOND YIELDS, 1977 - 1981

	Number of Issues	Mean Spread	Standard Deviation	Mean Spread Adjusted for Coupon Differentials	
				Adjusted by Eq. (8)	Adjusted by Eq. (9)
January 1977 - September 1979					
Aaa Bell Telephone Issues	27	0	11	3	-6
Aa Utility Issues	36	-13	24	-17	-28
Baa Utility Issues	32	-3	45	-3	-3
Aa Industrial Issues	13	-2	23	10	-21
A Industrial Issues	10	13	37	-10	-8
January 1980 - December 1981					
Aaa Bell Telephone Issues	18	53	50	45	41
Aa Utility Issues	18	42	58	37	18
Baa Utility Issues	17	53	52	50	61
Aa Industrial Issues	6	13	39	22	12
A Industrial Issues	18	12	64	14	27

Notes: Mean and standard deviation are in basis points.

Data exclude issues of intermediate-term, convertible, and original-issue discount bonds, and all bonds issued by foreign borrowers.

Data include all other issues of straight long-term debt, by domestic borrowers within the specified categories, with par value at least $100 million for Aaa Bell Telephone, Aa utility and Aa industrial issues, $50 million for A industrial issues, and $30 million for Baa utility issues.

Data from Moody's Investors Service, Inc. and Morgan Stanley & Co., Incorporated.

spreads like those shown in the second column of Table 2 may be misleading because of coupon differences between specific new issues and the outstanding issues used to compute the comparable seasoned yield indices. If two otherwise identical bonds bore different coupons but traded at the same yield nonetheless, the bond with the lower coupon would be more attractive to investors because of the lower probability of call. In addition, taxable investors would find the bond with the lower coupon (and hence lower price) more attractive because part of the return to holding it would take the form of capital gain and would therefore be subject to preferential tax treatment. For both reasons investors would bid up the price of the bond with the lower coupon so that in market equilibrium it traded at a lower overall yield. Hence when long-term interest rates in general are high in comparison to the coupons on the bonds that make up the comparable seasoned yield indices, so that the bonds in the index are trading at discounts from par, some positive spread between a new issue's yield and the comparable seasoned index is to be expected. Because the average level of long-term interest rates was sharply higher during 1980-81 than during 1977-79 (14.61% versus 9.22% for new issues of Aa-rated utility bonds, for example), it is at least possible that the rise in new issue versus seasoned yield spreads documented in Table 2 simply relected the associated coupon differentials rather than any effect on the market pricing mechanism due to increased interest rate volatility. Hence some allowance for the coupon differential is necessary.

In the absence of an exact measure of the relevant coupon differential for each new bond issue,[15] one way to control for the effect of changing coupon differentials on new issue versus seasoned yield spreads in this context is to relate the observed spread directly to the seasoned yield, as in the regression

$$(r_{Ni} - r_{Si}) = \beta_0 + \beta_1 r_{Si} + \delta_0 D_i + \delta_1 (D_i \cdot r_{Si}) \qquad (8)$$

where r_N is the yield on an individual new issue and r_S the yield on the comparable Moody's seasoned yield index on the day of that new issue, both measured in basis points; D is a dummy variable equal to 1 if the new issue appeared in the 1980-81 part of the sample and 0 otherwise; and the i subscript indicates a specific new issue. The rationale underlying (8) is that, for a given sample of bonds comprising the seasoned yield index, and for new issues priced approximately at par (which is usually the case), movements in the seasoned yield index r_S will be closely and positively correlated with movements in the differential between the coupon on each new issue and the mean coupon on the bonds comprising the index. To the extent that movements in r_S are a valid proxy for movements in the coupon differential, the implied coupon-adjusted yield spread is a simple function of the intercept and slope values in (8) together with the value of the mean coupon on the bonds in the index.[16] Because the presence of the dummy variable in (8) allows the intercept and slope to shift after October 1979, it also allows the implied coupon-adjusted yield spread to change.

The use of movements in r_S as a proxy for movements in the new issue versus seasoned yield index coupon differential in (8) is subject to two biases which act in opposite directions. First, because the mere existence of a positive coupon differential will cause a positive spread $(r_N - r_S)$, movements of r_S would <u>under</u>state the movement of the differential if the bonds used in compiling the seasoned index remained unchanged throughout the sample. Second, because Moody's Investors Service does change the composition of each index over time, however, typically by substitutions that bring the average coupon of the included bonds more nearly into line with prevailing new issue yields, movements of r_S would overstate the movement of the coupon differential if there were no resulting yield differential. On balance, how good a proxy r_S is for the coupon differential in a regression context depends on the extent to which these two biases offset one another.

Table 3 shows the results of estimating (8) for each of the five categories of bond issues included in Table 2, first subject to the constraint $\delta_0 = \delta_1 = 0$, next subject only to the constraint $\delta_1 = 0$ (so that the intercept may differ in the two parts of each sample), and finally subject to no constraint (so that both the intercept and the slope may differ). The basic regressions with $\delta_0 = \delta_1 = 0$ consistently show in β_1 the expected positive effect of the coupon differential (proxied by r_S), ranging from a maximum of 14 basis points of yield spread per 1% of coupon differential for Aaa-rated telephone issues to a minimum of 7 basis points of spread per 1% of differential for A-rated industrials. The intercepts β_0 are uniformly negative because the correction for the average difference between the mean level of r_S and the mean level of the coupon differential exceeds the mean yield spread after adjustment for the differential. The overall fit of the equations, and with it the significance level of the estimated slope coefficients, varies from surprisingly strong for the telephone issues to negligible for the A-rated industrials.

The results of estimating (8) with either the intercept or the intercept and the slope free to differ across the two subsamples are mixed. With $\delta_1 = 0$ still, the intercept shift δ_0 typically does not significantly differ from zero. With both coefficients free to change, the slope shift δ_1 is uniformly positive, and significantly so (at least marginally) for three categories of issues. At the same time δ_0 is uniformly negative, and

TABLE 3

ONE-VARIABLE REGRESSIONS FOR NEW ISSUE VERSUS SEASONED YIELD SPREAD

	β_0	β_1	δ_0	δ_1	$\bar{R}^2$	SE
Aaa Bell Telephone Issues	-130 (-7.6)	0.14 (9.1)	--	--	.64	25
	-191 (-6.3)	0.22 (6.4)	-39 (-2.4)	--	.68	24
	-50 (-0.7)	0.06 (0.7)	-233 (-2.7)	0.19 (2.2)	.70	23
Aa Utility Issues	-126 (-5.7)	0.13 (6.2)	--	--	.43	36
	-200 (-4.1)	0.20 (3.9)	-42 (-1.6)	--	.45	35
	1 (0.0)	-0.02 (-0.1)	-307 (-2.5)	0.27 (2.1)	.49	34
Baa Utility Issues	-99 (-3.4)	0.10 (4.1)	--	--	.24	47
	-90 (-1.2)	0.09 (1.2)	13 (0.3)	--	.23	48
	26 (0.2)	-0.03 (-0.2)	-140 (-0.8)	0.14 (0.9)	.23	48

TABLE 3 - Page 2

	β_0	β_1	δ_0	δ_1	$\bar{R}^2$	SE
Aa Industrial Issues	-76 (-1.7)	0.08 (1.7)	--	--	.11	29
	-167 (-1.9)	0.19 (1.9)	-38 (-1.2)	--	.13	30
	-109 (-0.8)	0.13 (0.8)	-164 (-0.8)	0.13 (0.6)	.10	29
A Industrial Issues	-83 (-1.4)	0.07 (1.4)	--	--	.04	55
	-96 (-1.0)	0.10 (1.0)	-7 (-0.2)	--	-.00	56
	277 (1.2)	-0.31 (-1.3)	-494 (-1.9)	0.49 (1.9)	.10	53

Notes: Numbers in parentheses are t-statistics.

$\bar{R}^2$ = coefficient of determination adjusted for degrees of freedom.

SE = standard of error of estimate (in basis points).

significantly so for the same three categories.

The fourth column of Table 2 reports mean new issue versus seasoned yield spreads that are comparable to those shown in the second column but adjusted for the effects of changing coupon differentials on the basis of the respective sets of estimated β_0, β_1, δ_0 and δ_1 values reported in Table 3 for the form of (8) with both δ_0 and δ_1 estimated freely.[17] The adjusted means for each specific category of issues differ somewhat from the unadjusted means, as is to be expected, but the widespread increase from the earlier to the latter part of the sample is still apparent. For all five categories combined, the mean adjusted spread was -5 basis points before October 1979 and 35 basis points after January 1980.

Although (8) includes a proxy variable to control for the coupon differential between new issues and the bonds comprising the comparable seasoned yield indices, it does not control for any of the other factors that both researchers and investment bankers have traditionally suggested as determinants of new issue pricing. An expanded relation that includes three other often cited elements of new issue pricing is

$$(r_{Ni} - r_{Si}) = \beta_0 + \beta_1 r_{Si} + \beta_2 (r_{Ti} - r_{Ni}) + \beta_3 MM_i + \beta_4 (\Delta r_{Ti}) + \delta_0 D_i + \delta_1 (D_i \cdot r_{Si}) \qquad (9)$$

where r_T is the yield on short-term Treasury bills on the day of the new issue, measured in basis points; MM is the size of the new issue, as a multiple of \$100 million; and Δr_T is the most recent one-month change in r_T. The conventional sign expectations for the associated coefficients are $\beta_2, \beta_3, \beta_4 > 0$. A positive cost of carrying bonds in inventory, measured by $(r_T - r_N)$, would lead to a larger spread $(r_N - r_S)$ if it induced underwriters to price a new issue so as to ensure a quick sale. A large issue size would lead to a large spread either because the market required a concession for size transactions or because of the greater risk to underwriters of holding more securities in syndicate. A rising interest rate level would lead to a larger spread if it created expectations of weaker market conditions ahead.

Table 4 presents the results of estimating (9) for each of the five categories of new issues, first subject to the constraint $\delta_0 = \delta_1 = 0$, next subject only to the constraint $\delta_1 = 0$, and finally subject to no constraint. Although none of the coefficients on the three new variables included in (9) is uniformly significant, all three typically exhibit the expected positive sign, and those on the issue size and expectation variables are at least marginally significant at least half the time. In the first equation for Aa-rated utilities, for example, $\beta_3 = .19$ indicates that an additional $100 million in issue size raises the new issue yield by 19 basis points after allowance for all other factors. Similarly, in the first equation for Baa-rated utilities, $\beta_4 = .15$ indicates that a recent increase of 1% in short-term interest rates raises the new issue yield by 15 basis points after allowance for all other factors.

Although the inclusion of the three additional variables in (9) leads to results that may shed interesting light on other questions, it does little to alter the basic implications for the question of shift in either intercept or coupon differential slope already contained in the results of estimating (8). Once again the intercept shift δ_0 is typically not significantly different from zero when the slope shift constraint $\delta_1 = 0$ is in effect. In the absence of constraints, δ_1 is again uniformly positive and δ_0 almost uniformly negative, with significance levels somewhat greater than those shown in Table 3.

TABLE 4

FOUR-VARIABLE REGRESSIONS FOR NEW ISSUE VERSUS SEASONED YIELD SPREAD

	β_0	β_1	β_2	β_3	β_4	δ_0	δ_1	$\bar{R}^2$	SE
Aaa Bell Telephone Issues	-137 (-6.6)	0.14 (7.9)	-0.00 (-0.2)	0.04 (0.9)	0.03 (0.7)	--	--	.63	26
	-214 (-6.4)	0.22 (6.6)	-0.01 (-0.3)	0.07 (1.7)	0.02 (0.6)	-46 (-2.8)	--	.69	24
	29 (0.4)	-0.04 (-0.5)	0.03 (1.5)	0.08 (2.1)	0.01 (0.2)	-343 (-3.5)	0.31 (3.1)	.74	21
Aa Utility Issues	-122 (-5.1)	0.11 (5.5)	0.04 (1.3)	0.19 (2.0)	-0.03 (-0.6)	--	--	.46	35
	-179 (-3.5)	0.18 (3.2)	0.03 (0.9)	0.20 (2.0)	-0.04 (-0.8)	-36 (-1.2)	--	.47	35
	61 (0.6)	-0.10 (-0.9)	0.04 (1.2)	0.23 (2.6)	-0.06 (-1.4)	-372 (-3.1)	0.34 (2.9)	.54	32
Baa Utility Issues	-117 (-3.2)	0.10 (4.0)	0.04 (0.8)	0.39 (1.8)	0.15 (1.8)	--	--	.31	45
	-25 (-0.3)	0.01 (0.2)	0.08 (1.3)	0.38 (1.7)	0.14 (1.7)	51 (1.1)	--	.31	45
	237 (1.4)	-0.25 (-1.5)	0.13 (2.0)	0.36 (1.7)	0.14 (1.8)	-236 (-1.5)	0.29 (1.8)	.35	44

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	β_0	β_1	β_2	β_3	β_4	δ_0	δ_1	$\bar{R}^2$	SE
Aa Industrial Issues	-51 (-1.0)	0.03 (0.7)	0.06 (1.5)	0.15 (1.7)	0.26 (2.3)	--	--	.36	25
	443 (1.0)	-0.51 (-1.1)	0.26 (1.4)	0.20 (2.0)	0.18 (1.4)	146 (1.1)	--	.37	24
	454 (1.0)	-0.52 (-1.1)	0.25 (1.3)	0.18 (1.7)	0.18 (1.4)	57 (0.2)	0.08 (0.4)	.33	25
A Industrial Issues	-89 (-1.6)	0.07 (1.6)	0.04 (0.8)	0.16 (1.1)	0.17 (3.4)	--	--	.43	42
	80 (0.7)	-0.11 (-1.0)	0.10 (1.8)	0.13 (1.0)	0.17 (3.4)	75 (1.8)	--	.48	40
	418 (2.4)	-0.46 (-2.6)	0.11 (2.0)	0.10 (0.8)	0.16 (3.6)	-353 (-2.0)	0.43 (2.4)	.58	36

Notes: Numbers in parentheses are t-statistics.

$\bar{R}^2$ = coefficient of determination adjusted for degrees of freedom.

SE = standard error of estimate (in basis points).

The final column of Table 2 reports mean new issue versus seasoned yield spreads that are again comparable to those shown in the second and fourth columns but adjusted for coupon differential effects on the basis of the respected sets of estimated β_0, β_1, δ_0 and δ_1 values reported in Table 4 for the form of (9) with both δ_0 and δ_1 estimated freely. Once again the prevalent increase is clearly apparent. For all five categories combined, the mean adjusted spread was -14 basis points before October 1979 and 35 basis points after January 1980.

Finally, Table 5 presents F-statistics for a Chow test of the null hypothesis of no change in the respective full sets of β coefficients in each of (8) and (9), across the 1977-79 and 1980-81 subsamples. These results simply confirm the impression already given by the t-statistics of δ_0 and δ_1 in Tables 3 and 4.[18] For three of the five categories of new issues, there is highly significant evidence of a change in the behavior of the market's new issue pricing mechanism between the respective experience before and after October 1979.

TABLE 5

F-STATISTICS FOR BREAK IN SPREAD RELATIONSHIPS

	Equation (8)	Equation (9)
Aaa Bell Telephone Issues	12.34*	12.80*
Aa Utility Issues	4.14*	4.31*
Baa Utility Issues	1.15	1.74
Aa Industrial Issues	2.17	1.13
A Industrial Issues	9.89*	12.48*

Note: *Significant at .01 level.

III. Effects of Volatility on the Distribution of Bond Purchases

The evidence presented in Sections I and II, suggesting changes in the operation of the U.S. long-term corporate capital market since October 1979, focuses first on borrowing corporations and then on the market intermediary as represented by the underwriting mechanism. The other side of the market, of course, is the lender -- that is, the investor who ultimately holds nonfinancial corporations' bonds. Just as nonfinancial corporations and investment bankers may have changed their respective ways of doing business in response to the increase in interest rate volatility, so too may portfolio investors.

Even the most casual conversations with participants in the U.S. corporate bond market in recent times almost inevitably lead to some form of assertion that the behavior of investors in the market has indeed changed during the past two years. The notion which most typically arises is that purchasers of long-term bonds have become "speculators" rather than "investors," making portfolio decisions more on the basis of expectations of capital gain (or fears of capital loss) over very short time horizons instead of assessments of prevailing interest rates in the context of longer-run portfolio objectives. To be sure, this process has been under way for many years, as the bond market itself has become more liquid and interest rate (and hence bond price) fluctuations have intensified since the relatively tranquil days of the early 1960s. Even so, the overwhelming consensus among market participants appears to be that the acceleration of this process during the past two years has constituted a qualitatively new phenomenon. If true, such a development would be at least consistent with — if not directly due to — the sharp increase in interest rate volatility in this period.

There are many senses in which it could be true that "speculation" has replaced "investment" as a mode of behavior on the lenders' side of the bond market. The same individuals and institutions that played active roles in the market before could still be doing so, but could have changed their respective patterns of portfolio behavior. In addition -- or alternatively -- the more risk averse or far sighted individuals could have withdrawn from the market, with other individuals who are more comfortable with risk yet more concerned with short-run portfolio performance taking their places; and a similar exchange of places could have occurred among institutions. While both of these interpretations of the widespread perception of change are entirely plausible, providing evidence to document or contradict either possibility lies well beyond the scope of this paper.

Another, more readily explored, sense in which the market's behavior may have changed is that some specific classes of investors could have reduced their participation, with other specific investor classes taking their place. Because of the great diversity of legal and regulatory constraints under which various kinds of financial institutions operate in the United States, not to mention the divergence in specific practice appropriate to their respective lines of business, different classes of institutions typically exhibit sharply different portfolio behavior.[19] To the extent that such classes of investors exhibit portfolio behavior which is more homogeneous within classes than across classes, any shifts in the relative importance of specific classes' market participation imply changes in the equilibrium characteristics of the overall market.[20]

Table 6 presents data for the last two decades showing the breakdown, according to the classification of sectors in the Federal Reserve System's flow-of-funds accounts, of all net purchases of corporate bonds issued in the United States. The data shown are by five-year averages of market shares

TABLE 6

DISTRIBUTION OF NET PURCHASES OF CORPORATE BONDS BY SECTOR, 1960 - 1981

	Households	Life Insurance Companies	Other Insurance Companies	Private Pension Funds	State-Local Retirement Funds	Commercial Banks	Mutual Savings Banks	Brokers and Dealers	Mutual Funds	Foreign
1960-64	-0.7	40.7	2.6	24.5	30.6	-0.9	-1.9	0.3	3.6	1.2
1965-69	22.0	23.5	6.3	11.4	24.9	1.1	5.0	1.7	2.6	1.6
1970-74	29.6	23.9	3.0	6.2	23.5	4.1	5.5	0.4	1.9	1.8
1975	24.3	24.8	6.0	4.9	18.5	4.9	9.5	3.3	1.9	1.6
1976	28.6	41.0	9.5	-0.7	12.4	-1.5	6.8	1.2	0.7	2.2
1977	-10.5	52.1	10.2	15.0	16.6	-0.1	3.3	0.6	3.0	10.5
1978	-9.1	54.4	5.7	18.6	28.3	-0.9	0.3	-0.9	-2.2	6.0
1979	31.4	35.4	6.1	17.4	9.8	-0.3	-3.4	-1.8	2.4	3.0
1980	9.4	22.7	9.4	11.5	25.3	1.6	1.8	2.1	3.4	13.3
1981:Q1-Q3	-106.6	58.9	18.7	10.8	47.9	1.7	-5.8	25.9	8.3	39.6

Notes: Data are percentage shares of total net purchases of corporate bonds issued in the United States.

Detail may not add to 100% because of rounding.

Source: Board of Governors of the Federal Reserve System.

for the first fifteen years of this period, then individually for the five years leading up to and including the October 1979 change in monetary policy procedures, and then individually for the two subsequent years in which interest rate volatility has been so much greater.

Although many regularities do emerge in an inspection of these data -- for example, the historical and continuing role of life insurance companies and state-local government retirement funds as major providers of long-term debt capital to business -- the data also convey an impression of enormous variation from year to year in the distribution of net bond purchases, depending on the specific market circumstances. Just within the five years 1975-79, for example, the share of total net bond purchases accounted for by life insurance companies varied from barely one-fourth to over one-half. Similarly, households accounted for more than one-fourth of all net purchases in 1976 and nearly one-third in 1979, but were themselves net sellers of corporate bonds in each of the two intervening years.[21]

Against the background of this substantial variation, the chief aspects of the distribution of bond purchases since October 1979 that have been clearly out of the ordinary all occurred during 1981: the unprecedented liquidation of bond holdings by households, the unprecedented absorption of bonds by securities brokers and dealers, and the unprecedented absorption of bonds by foreign investors. During the first three quarters of last year (the latest period for which data are available at the time of writing), the net sale of bonds by households exceeded the market's entire net new issue volume. In other words, because of net selling by households, all other classes of investors together absorbed more than twice the net amount of bonds that would have been necessary to clear the market if the only net "sales" had come from net new borrowing by corporate issuers. Securities brokers and dealers and foreign investors, however, increased their bond purchases by well over a factor of two.

The massive liquidation of bond portfolios by households in 1981 was clearly extraordinary, but its connection to the post October 1979 increase in interest rate volatility is hardly obvious. Not only was there no such liquidation in 1980, but that which occurred during 1981 took place entirely in the second and third quarters of the year. These six months were a peak period for long-term interest rates, and many individuals may have been responding more to the opportunity to create tax losses before the 1981 legislation lowered marginal tax rates than to any aversion to volatility per se. More broadly, still other factors like the weakness of personal income associated with the renewed recession in business activity may also have been partly responsible. In the absence of a specific model of households' portfolio behavior that allows for as many such factors as possible -- in short, an analog to the model of nonfinancial corporations' borrowing behavior in (5) -- no strong inference linking this shift in households' bond market activity to interest rate volatility is warranted.[22]

The increased share of net bond purchases accounted for by securities brokers and dealers and by foreign investors is more clearly consistent with the commonly perceived shift in the market's character. Wholly apart from the question of whether the increase in interest rate volatility per se motivated these two investor groups' increased participation, they are more likely to exhibit "speculative" behavior than are the traditional major bond investors like life insurance companies and pension funds.

In sum, despite an unprecedented change in households' bond market portfolio behavior since October 1979, and an accompanying change in that of securities brokers and dealers and foreign investors, there is no clear evidence that the increase in interest rate volatility has altered behavior on the lenders' side of the U.S. corporate bond market.

IV. Concluding Remarks

The evidence presented in this paper leads to three conclusions about possible effects on the U.S. long-term capital raising mechanism due to the sharp increase in interest rate volatility that has followed the Federal Reserve System's adoption of new monetary policy procedures in 1979. First, the increased volatility has probably led nonfinancial corporations to finance less of their external funds requirements at long term than they would otherwise have done. Second, the increased volatility has probably led underwriters of high grade corporate bonds to increase the spread of a typical new issue's yield over the prevailing market yield on comparable bonds already outstanding. Third, there is little firm basis (reported here, anyway) to conclude that the increased volatility in particular has affected investors' portfolio behavior in the bond market.

Each of these three conclusions (especially the two positive ones) bears treating with substantial caution. The experience from October 1979 to date spans too short an interval to support any judgment with confidence, given the difficulties that always hinder economic inference. Moreover, the specific aspects of economic behavior under scrutiny here -- corporate finance, investment banking, and portfolio investment -- are sufficiently imperfectly understood at a quantitative level to render sharp judgments risky even on the basis of more ample data. Further, the research reported in this paper carries none of the three separate analyses conducted to the full depth feasible within even the limited data and analytical tools available.

Even so, the conclusions reached here about the effects of increased interest rate volatility on the capital raising mechanism are suggestive. Because the potential economic consequences of significantly impairing that mechanism are great, even these tentative conclusions should serve both as a warning of caution for public policy and as a spur to further research.

Footnotes

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1. It is always possible, of course, that the increase in interest rate volatility since October 1979 has occurred for reasons unrelated to the change in Federal Reserve operating procedures. An analysis of the effects of that volatility would still be useful in that case, but its conclusions would then carry no implications for monetary policy.

2. The analysis focuses on a subset of the effects investigated empirically by Johnson et al. [10] and considered at the a priori level by Lombra and Struble [14]; see both papers for references to the relevant earlier literature on interest rate volatility.

3. See Friedman and Roley [9] for a proof of this proposition, together with expressions deriving the β_{ik} and π_i in (1) from the parameters of the joint distribution of the yield assessments and the borrower's (or investor's) coefficient of relative risk aversion. The form of (1) used in Friedman [7] also allowed for several non-yield influences on portfolio selection, but none of these proved statistically significant in the estimated equation presented below; see footnote 6.

4. See Friedman [5] for the development of the optimal marginal adjustment model, and Friedman [7] for its application in the context of corporations' choice of liabilities.

5. The time shapes of these "average" expectations depend on the results of a dynamic programing optimization involving, among other factors, the associated perceived variances and covariances; see the model of call-deferred optimal financing in Bodie and Friedman [2].

6. The equation presented here also omits several non-yield variables included in Friedman [7], as well as the expected inflation proxy included in Friedman [6]. Despite the a priori expectation of a nonzero coefficient in the expanded model, in each case preliminary experimentation did not indicate a value significantly different from zero. For the retained earnings and fixed investment variables, the most important of the non-yield influences in [7], the estimated coefficients (and t-statistics) were 0.6275 (1.5) and 0.04277 (0.1), respectively. For the expected inflation proxy the estimated coefficient was -0.02577 (-0.4).

7. All γ_τ and δ_τ values in (6) and (7) have t-statistics in excess of 1.9 except γ_{11} - γ_{13} and δ_2. The role of the unit sum constraint is to permit identification of the corresponding coefficients in (5), and the interpretation of those two coefficients is of course conditional on the unit

sum constraint. The estimation procedure used here also constrains each set of lag weights to follow a third-degree polynomial pattern, with the right-hand tial of the lag constrained to pass through zero, and with each lead weight (γ_0 or δ_1) free of the polynomial constraint but still included in the unit sum constraint. See Friedman [7] for further details of the estimation process.

8. A third important aspect of the equation's post-sample over-prediction is that these data on "actual long-term borrowing" in fact include both long- and intermediate-term issues. The shift in the mix of new issue maturities from long to intermediate term during the last two years further compounds the result shown here.

9. Simply introducing an interest rate volatility measure on the right-hand side of (5) leads, as would be expected, to a negative coefficient that is significant at the 5% level when the equation is estimated over 1960:II - 1981:II, but not over 1960:II - 1979:III. For all of the reasons advanced above, however, such a finding is of questionable value. Practically any variable that has shown a sudden increase after mid 1979 would produce similar results.

10. The t-statistics for the three individual coefficient shifts were 2.8 for β_{B1}, -2.5 for β_{B2} and -3.0 for β_{B3}.

11. The predicted values shown in Table 1 rely on period-by-period updating of all right-hand side variables in (5), including the lagged interest rate observations in (6) and (7).

12. Adding an interest rate volatility measure to any standard unrestricted reduced-form term-structure equation, estimated directly with the long-term yield as the dependent variable, would presumably result in a significantly positive coefficient. It is not clear what such an exercise would contribute to understanding of interest rate relationships, however; see again footnote 9.

13. Researchers investigating the underwriting of new equity issues have found more mixed results on this question, although the respective hypotheses for the cases of bond and stock issues are not fully comparable. See, for example, Scholes [15], Logue [13] and Stoll [16].

14. A break-down between issues priced by negotiation versus competitive bidding, within the utility (and post-1979 Bell Telephone) groups, showed no apparent differences that would warrant allowing for this distinction in the analysis that follows. The omission of the final three months of 1979, on the ground that underwriters would have needed some time to observe the increase in interest rate volatility before reacting to it, has essentially no effect on the results reported here (and in Tables 3-5 below) because there were so few issues during those months. For the five categories of issues shown in the table, the numbers of new issues during October-December 1979 were, respectively, 2, 6, 1, 0 and 0.

15. Following Conard and Frankena, an alternative approach would be to construct a separate yield index with average coupon identical to that of each new issue. This approach would be difficult to implement, not only because of the amount of data manipulation required but also because of the need for tenuously based interpolation and extrapolation for many issues.

16. More specifically, assume that the composition of the index is fixed and that the bonds in the index are priced at par on average over time, so that the mean seasoned index coupon is $k_S = \overline{r}_S$ where $\overline{r}_S$ is the mean observed value of r_S during the sample period. Also assume that each new issue is priced at par and — now abstracting from the yield effect of the coupon differential — at a yield equal to that on comparable seasoned issues, so that the coupon on any new issue is $k_N = r_S$. (As the discussion below explains, each of these assumptions introduces a bias of known sign in what follows.) If the relationship between the yield spread and the coupon differential is the linear $r_N - r_S = \alpha + \beta(k_N - k_S)$, then substituting and rearranging yields (8) where, apart from the dummy variable, $\beta_0 = \alpha - \beta\overline{r}_S$ and $\beta_1 = \beta$. Because the equation includes an intercept, there is no implication that the <u>level</u> of r_S is a proxy for the <u>level</u> of the coupon differential.

17. The two values reported for each category of bonds are, first, $\beta_0 + \beta_1\overline{r}_S$ where $\overline{r}_S$ is the 1977-79 mean of r_S and, second, $\beta_0 + \delta_0 + (\beta_1 + \delta_1)\overline{r}_S$ where $\overline{r}_S$ is the 1980-81 mean of r_S. See again footnote 16.

18. For (8) this result is to be expected, in that the F-statistic just shows the joint significance of δ_0 and δ_1 together. For (9) the F-statistic applies to a test for no change not only in β_0 and β_1 but also in β_2, β_3 and β_4.

19. See, for example, the evidence along these lines presented in Friedman [5].

20. See Lintner [12] and Friedman [8] for proofs of this proposition in two different contexts.

21. Households cannot issue new corporate bonds, of course; net sales represent an excess of aggregate gross sales of bonds already held in portfolios over aggregate gross purchases. The household sector of the flow-of-funds accounts consists primarily of individuals but also includes non-profit institutions and bank-managed personal trusts.

22. The converse is also true for the other investor classes. Post 1979 behavior that appears ordinary enough on casual inspection may be unusual in the context of a model allowing for independent factors. An approach to this problem analogous to that employed in Section I would be to estimate the six bond demand equations developed in Friedman [5] using data through 1979:III, and then test the estimated relationships using post-sample data. Such an investigation lies beyond the scope of this paper.

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