The Effects of Inflation on Commercial Banks

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PEOPLE disagree about the effect of the recent decline in inflation on U.S. financial institutions. Some claim that the "sudden drop in inflation . . . put the country's whole credit structure under great strains that are becoming increasingly apparent."[1] One of the more important indicators of the "strain," according to this argument, is the increase in bank failures.[2] Others argue that financial institutions have been the "beneficiaries of disinflation and falling interest rates," pointing out that commercial bank earnings increased as the inflation rate fell.[3]

This article discusses the effect of inflation on commercial banks by analyzing the relationship between inflation and the market value of bank capital.

INFLATION: A BRIEF EXPLANATION

Inflation is an increase in the general price level, and is typically expressed as an annual percentage rate of change. For example, the GNP deflator (one index of the general price level) rose from 1.00 in 1982 to 1.038 in 1983, then increased to 1.081 in 1984. Inflation averaged 3.8 percent during 1982–83 and about 4.1 percent during 1983–84. The average annual rate over the two-year interval was about 3.9 percent.[4]

Inflation depreciates the value of money. An inflation rate of 4.0 percent means that the dollar falls in value at an annual rate of 4.0 percent in terms of the goods it will buy.

BANKS AND NOMINAL FINANCIAL INSTRUMENTS

Inflation is important for banks because they typically deal in *nominal* financial instruments, that is, instruments denominated in fixed dollar amounts. For example, when a bank makes a loan, it accepts nominal financial instruments (notes, mortgages, commercial paper and other financial securities) as evidence of the debtor's obligation to the bank. When a bank borrows, it issues nominal financial instruments to creditors (deposit liabilities, acceptances and debentures) as evidence of its obligation.

An Important Characteristic

While nominal financial instruments differ from one another in many respects, they share one important characteristic: their payments are fixed in nominal value, that is, in terms of dollars. Nominal instruments make up the bulk of bank assets and liabilities. Furthermore, banks are typically net creditors in nominal instruments because their nominal assets exceed their nominal liabilities (see appendix 1 for a theoretical explanation).[5]

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[1]See Shaky Credit Structure (1985).

[2]*Ibid.*

[3]See Corporate Earnings Uneven (1985).

[4]There are various methods of computing average annual rates of change. The method employed in this paper assumes continuous compounding. The rates are calculated by dividing the difference between the natural logarithms of the price level at the two points in time by the number of intervening years and multiplying by 100.

[5]See Alchian and Kessel (1977a) and Kessel (1956). Of course, banks have real assets and liabilities as well (land, buildings, office equipment, equities, etc.). These, however, make up a very small portion of bank portfolios and are irrelevant in assessing the effect of inflation on banks.

Some Balance Sheet Data

Table 1 uses data from the consolidated balance sheet of domestically chartered commercial banks to illustrate their net position in nominal instruments.[6] Nominal assets are calculated by subtracting the values of bank premises, other real estate owned, the equities of other firms owned, and investment in subsidiaries from total assets. These items are subtracted because the market prices of real assets vary directly with the price level. Nominal liabilities are the sum of total deposits, subordinated notes and debentures, federal funds purchased, interest-bearing demand notes, mortgage indebtedness, all other liabilities for borrowed money and the value of preferred stock. Preferred stock, which is similar to a bond, is included as a nominal liability because it is an obligation of the bank to pay a fixed stream of dollars.

The table 1 data indicate that, in the aggregate, the nominal assets of these banks exceed their nominal liabilities. The excess of nominal assets over nominal liabilities amounts to 66.3 percent of bank capital.[7]

Table 1
Net Nominal Assets of All Commercial Banks (in billions of dollars)

Nominal assets = total assets − real assets		
Total assets		$2,681.0
Less real assets:		
Equity ownership in other firms	$10.7	
Bank premises	39.7	
Investment in subsidiaries	1.9	
Real estate other than premises	6.9	59.2
Nominal assets		$2,621.8
Nominal liabilities[1] = total liabilities + preferred stock		
Total liabilities		$2,504.5
Preferred stock		1.0
Nominal liabilities		$2,505.5
Net nominal assets = nominal assets − nominal liabilities		
Nominal assets		$2,621.8
Nominal liabilities		2,505.5
Net nominal assets		$ 116.3
Net nominal assets as a percent of equity		66.3%

NOTE: Data are as of third quarter 1985.
[1]All bank liabilities are nominal.
SOURCE: Board of Governors of the Federal Reserve System

ANTICIPATED INFLATION AND BANKS

An increase in anticipated inflation raises the nominal interest rate. This increases the number of dollars that creditors or debtors who are transacting in nominal financial instruments expect to receive or pay when loans mature (see shaded insert). If these expectations are realized, all nominal values will be higher at maturity. Table 2 shows this effect on the balance sheet of a hypothetical bank. The example assumes that all of the bank's borrowing and lending contracts were negotiated with the expectation that the rate of inflation over the next two years would be 5.0 percent. The bank's loan contracts have a two-year life. Its borrowing contracts mature at the end of each year and are renegotiated at the existing interest rate. Reserve requirements against all deposits are 10.0 percent.

For simplicity, the real interest rate is assumed to be zero so the nominal interest rate on bank loans is 5.0 percent.[8] The interest rate on bank deposits is 4.5 percent. The spread between the bank's borrowing and lending rates is necessary compensation for the requirement to hold non-interest-earning reserves (see appendix 1). All assets and liabilities are valued at market prices so assets minus liabilities, or capital, represents the market value of the bank, $200, in this example. The general level of prices is 1.0 in panel A.

Panel B shows the balance sheet of the bank at the end of the first year assuming that the anticipated inflation is realized and that nothing else has occurred to change the account balances. Accrued interest on deposit liabilities is $45, while $50 interest has accrued on bank loans. A portion of the bank's interest earnings ($4.50) must be added to reserves to cover the increase in deposits. The nominal value of bank capital has increased to $210.00, but its real value is unchanged ($200.00).

A similar result occurs in panel C, which shows the balance sheet at the end of the second year. The anticipated inflation has no real effect on the bank's capital and, therefore, on the wealth of its stockholders.

[6]This calculation should be considered as illustrative only, since book values rather than market values are used.

[7]As above, capital excludes outstanding preferred stock.

[8]The assumption about the real rate has no qualitative effect on the results. See appendix 1.

Forecasting Inflation

Anticipated and Unanticipated Inflation

Many economic transactions require a commitment to exchange money at some future time. Credit transactions are a good example of this. Since inflation reduces the future value of money, it pays people (both potential borrowers and lenders) to try to forecast inflation over the relevant time period. This forecast is called *anticipated* inflation.[1] As the name suggests, anticipated inflation is forward-looking. It is the rate of change in the general price level that people think will occur during some specific future time period.

Of course, the accuracy of inflation forecasts depends on future events and circumstances that are unknown when the forecast is made. Consequently, these forecasts generally will be "wrong."[2] Any difference between actual (or realized) inflation and anticipated inflation is called *unanticipated* inflation. Unanticipated inflation is known only with hindsight. Because it is known only after the fact, it plays no role in people's decisions. It is important, however, in assessing whether the decisions produced profits or losses.

[1]See Alchian and Allen (1977), p. 490. They note that "though odd names are given to inflation (creeping, galloping, runaway, and hyper-), a critical distinction is between *unanticipated* and *anticipated* inflation."

[2]Economic theory suggests that, although "wrong," the forecasts will not consistently over- or underpredict; that is, forecasts will be unbiased. See Fisher (1954), pp. 36-37; Fisher (1907), p. 213; and Fama (1970) for discussions of business foresight and efficient markets.

Anticipated Inflation and Interest Rates

The nominal interest rates quoted in financial markets are formed in the process of contracting between borrowers and lenders. They indicate the number of dollars the borrower must pay to the creditor in the future in exchange for a given number of present dollars. If borrowers and lenders expect the value of the dollar to depreciate in terms of the goods it will buy over the life of the loan (i.e., if they anticipate inflation), the nominal interest rate specified in the loan contract will take account of this. The interest rate will be sufficiently high to compensate for the expected depreciation in the value of the dollar.[3]

To illustrate, suppose the real interest rate is 3 percent and the anticipated rate of inflation over the coming year is 5 percent. People think that it will take $1.05 one year from now to purchase the goods that $1.00 will buy today. A loan of $1,000 for one year will require a payment of $1,081.50 (= $1,000.00 × 1.03 × 1.05) at maturity. This implies a nominal interest rate of 8.15 percent.[4] The anticipated real value of this amount at maturity is $1,030 (= $1,081.50/1.05), which is the sum of the principal ($1,000) and the real return ($30).

[3]See Fisher (1965), pp. 1-100, who relates the nominal interest rate, i, to the *ex ante* real interest rate, r, and the anticipated rate of inflation, π^*, as follows:

$$i = r + \pi^* + (r)(\pi^*).$$

Fisher's hypothesis regarding the formation of the nominal interest rate is an approximation to the "true" relationship; it ignores risk premiums and the effect of taxes on interest income and assumes that the anticipated rate of inflation is held with certainty. See Darby (1975) and Kochin (1981). The *ex ante* real rate is the premium in terms of real goods that creditors expect to receive (and borrowers expect to pay) expressed as a percentage of the principal of the loan. See Fisher (1954) and Santoni and Stone (1981) for discussions of the real rate of interest.

[4]8.15 = [($1,081.50/$1,000.00) − 1]100.

UNANTICIPATED INFLATION AND BANKS

If the realized rate of inflation exceeds the anticipated rate, the price level has risen unexpectedly. The unexpected increase in the price level causes a proportional reduction in the exchange value of both nominal financial assets and liabilities in terms of real goods. Because banks are typically net creditors in nominal instruments, bank owners lose wealth when there is unanticipated inflation (that is, when bank capital declines).[9]

Table 3 presents a numerical example of this effect. The assumptions in table 3 are the same as those in table 2 except that people are surprised by a 10 percent increase in the price level in the first year. The example assumes that the surprise is interpreted as a

[9]See Keynes (1923), pp. 18–19, and Alchian and Kessel (1977b).

Table 2
The Effect of an Anticipated Inflation of 5.0 Percent

Panel A: The current balance sheet. The price level is 1.0.

Assets:		Liabilities:	
Reserves	$ 100.00	Deposits	$1,000.00
Loans and securities	1,000.00	Capital:	200.00
Premises	100.00		$1,200.00
	$1,200.00		

Panel B: The balance sheet one year hence. The price level is 1.05.

Assets:		Liabilities:	
Reserves	$ 104.50	Deposits	$1,045.00
Loans and securities	1,045.50	Capital:	210.00
Premises	105.00		$1,255.00
	$1,255.00		

Real value of capital = $210/1.05 = $200

Panel C: The balance sheet two years hence. The price level is 1.1025.

Assets:		Liabilities:	
Reserves	$ 109.20	Deposits	$1,092.02
Loans and securities	1,093.07	Capital:	220.50
Premises	110.25		$1,312.52
	$1,312.52		

Real value of capital = $220.5/1.1025 = $200

one-time-only deviation in the price level so that the inflation forecast for the second year remains at 5.0 percent.

Panel B shows the effect of the unanticipated inflation. The bank's nominal assets and liabilities are unaffected by the inflationary surprise. The increase in these dollar values is fixed by contract. In contrast, the nominal value of the bank's real assets, the premises, increases by the realized rate of inflation, 10.0 percent. The nominal value of capital increases from $200 to $215. The value of the bank in terms of the real goods for which it can be exchanged, however, declines to $195.45. The unanticipated inflation causes the real value of the bank to fall by $4.55.[10]

Panel C shows the bank's balance sheet at the end of the second year. The real value of the bank remains at $195.45, indicating that the one-time inflationary surprise produces a permanent reduction in the real value of the bank even though the rate of inflation in subsequent years returns to 5.0 percent.

THE INTEREST RATE AND INFLATION

A bank's nominal financial assets and liabilities typically mature at different dates. At any given moment, the maturity dates of a bank's assets generally extend beyond those of its liabilities.[11] In other words, an

[10]An unanticipated decrease in the price level produces symmetrical results in that the real wealth of bank owners is increased.

[11]More precisely, the duration of the bank's receipt stream exceeds the duration of its payment stream. For discussions of duration, see Samuelson (1945), p. 19; Bierwag, Kaufman and Toevs (1983); Maisel and Jacobson (1978); and Santoni (1984).

Table 3
The Effect of an Unanticipated Inflation

Panel A: The current balance sheet. The price level is 1.0.

Assets:		Liabilities:	
Reserves	$ 100.00	Deposits	$1,000.00
Loans and securities	1,000.00	Capital:	200.00
Premises	100.00		$1,200.00
	$1,200.00		

Nominal assets − nominal liabilities = ($100 + $1,000) − $1,000 = $100
Real value of capital = $200/1.0 = $200

Panel B: The balance sheet one year hence. The price level is 1.10.

Assets:		Liabilities:	
Reserves	$ 104.50	Deposits	$1,045.00
Loans and securities	1,045.50	Capital:	215.00
Premises	110.00		$1,260.00
	$1,260.00		

Real value of capital = $215/1.10 = $195.45

Panel C: The balance sheet two years hence. The price level is 1.155.

Assets:		Liabilities:	
Reserves	$ 109.20	Deposits	$1,092.02
Loans and securities	1,093.07	Capital:	225.75
Premises	115.50		$1,317.77
	$1,317.77		

Real value of capital = $225.75/1.155 = $195.45

interest rate change affects the payment stream obligated by the bank's liabilities before it affects the bank's receipt stream. Consequently, an increase in the interest rate reduces the expected net stream of dollar receipts as the bank's creditors renegotiate for the higher interest rate, while the interest rate earned by the bank on its existing loans is locked up. Of course, the loans eventually mature and are renegotiated at the higher nominal rate, but the bank's capital is reduced nonetheless.

An Illustration

Table 4 illustrates the effect of a change in the nominal interest rate on bank capital. The example assumes the interest rate increases because anticipated inflation increases. The qualitative effect illustrated by the example, however, results from the change in the interest rate, regardless of what produced the change.

In this example, anticipated inflation at the time the bank initially contracts with its creditors and debtors is 5.0 percent. The bank's contracts with its creditors mature in one year, while its loans mature at the end of the second year and cannot be renegotiated before maturity.

As in the previous examples, the bank's loans and

Table 4

The Effect of a Change in Anticipated Inflation

Panel A: The current balance sheet. The price level is 1.0.

Assets:		Liabilities:	
Reserves	$ 100.00	Deposits	$1,000.00
Loans and securities	1,000.00	Capital:	200.00
Premises	100.00		$1,200.00
	$1,200.00		

Panel B: The balance sheet one year hence. The price level is 1.05.

Assets:		Liabilities:	
Reserves	$ 104.50	Deposits	$1,045.00
Loans and securities	1,045.50	Capital:	210.00
Premises	105.00		$1,255.00
	$1,255.00		

Real value of capital = $210.00/1.05 = $200.00

Panel C: The balance sheet two years hence. The price level is 1.155.

Assets:		Liabilities:	
Reserves	$ 113.90	Deposits	$1,139.05
Loans and securities	1,090.65	Capital:	181.00
Premises	115.50		$1,320.05
	$1,320.05		

Real value of capital = $181.00/1.155 = $156.71

deposits are $1,000. The lending rate is 5.0 percent, and the borrowing rate is 4.5 percent. Panel A shows the bank's initial balance sheet. Panel B shows the balance sheet at the end of the first year assuming that the realized rate of inflation during the first year was 5.0 percent, the same as the anticipated rate.

Panel C shows the balance sheet at the end of the second year assuming that the anticipated rate of inflation was revised upward to 10.0 percent at the beginning of the second year, just before the bank renegotiated its contracts with depositors. The example assumes that the realized rate of inflation during the second year matches the anticipated rate.

The increase in anticipated inflation causes the nominal interest rate to rise to 10.0 percent during the second year, while the interest rate on bank deposits increases to 9.0 percent. At the end of the second year, these deposits will amount to $1,139.05 (= $1,045.00 × 1.09). The bank, however, is prevented from raising the interest rate on its existing loans (= $1,000) by the terms of its contract. These loans continue to yield 5.0 percent in the second year, accruing earnings of $50.00 during the year. Of course, the bank can make new loans of $45.50 at the beginning of the second year. These new loans, which result from the net interest earnings the bank obtained the first year, are made at the higher interest rate (10.0 percent) and accrue earnings of $4.55 (= $45.50 × .10) at year-end.

Since bank deposits increased during the second year, some of the bank's interest earnings must be used to increase reserves. The increase in bank deposits amounts to $94.05 (= $1,139.05 − $1,045.00), so reserves must increase to \$113.90 or by \$9.40 (= \$94.05 × .10). As a result, the bank's loan account at year-end is \$1,090.65 (= \$1,000.00 + \$50.00 + \$45.50 + \$4.55 − \$9.40). Bank premises increase in nominal value by the realized rate of inflation and amount to \$115.50 (= \$105.00 × 1.10) at year-end. Note that both the nominal and real value of capital decline. The real value of capital falls by \$43.29 to \$156.71 (= \$181.00/1.155).

As the table 4 example shows, a change in the interest rate can have a fairly substantial effect on the bank when the maturities of the bank's assets and liabilities differ. In this particular example, the real value of capital declined by about 22.0 percent when the interest rate doubled.

An increase in anticipated inflation affects banks in a way that is qualitatively the same as unanticipated inflation. This is because the upward revision in anticipated inflation that occurs at the end of the first year was not forecast at the beginning of the year. If people had anticipated inflation of 5.0 percent the first year and 10.0 percent the second year, the rate of interest on two-year loans would not have been 5.0 percent. Rather, it would have been higher to reflect the fact that anticipated inflation averages 7.2 percent across the two years. Unanticipated inflation and changes in anticipated inflation have similar effects because both reflect a misguess about inflation.

To recap the main points so far, the previous discussion suggests that inflation affects the real capital value of banks through two channels. First, capital value falls when the actual rate of inflation exceeds the anticipated rate. This is called unanticipated inflation. Second, capital value falls when the anticipated rate of inflation is revised upward, because this causes nominal interest rates to rise unexpectedly. The reverse occurs if the actual rate of inflation falls short of the anticipated rate or if the anticipated rate of inflation is revised downward.

SOME ESTIMATES

These implications can be examined by observing the effect of inflation on various indexes of the stock prices of publicly traded banks. Stock prices are used as a proxy for the capital value of banks because they represent the market's assessment of the present value of the future net receipts banks are expected to generate.

The relationship between changes in the real stock prices of banks and the other variables is assumed to take the form shown in equation 1:

$$(1)\quad \Delta Ln(V/P)_t = C + \alpha\Delta Lny_t + \beta\Delta Ln(i-\pi^*)_t + \gamma\pi^u_t + \delta\pi^* + \varepsilon\Delta L\eta\pi^*,$$

where

V/P = the real price of bank stock,
C = a constant,
y = real income,
$(i-\pi^*)$ = the nominal interest rate less anticipated inflation,
π^u = unanticipated inflation, which is the difference between realized inflation, π, and anticipated inflation, π^*. $\pi^u \gtreqless 0$.

Equation 1 expresses real stock prices, real income, the interest rate residual and the change in anticipated inflation in terms of annualized percentage changes. The unanticipated rate of inflation is the difference between two annualized percentage rates of change: the realized rate of inflation and the anticipated rate. The estimates use quarterly data from the first quarter of 1962 through the fourth quarter of 1984.

Anticipated and Unanticipated Inflation

Measuring anticipated inflation is a problem. Since we only observe actual inflation, various analysts have used different methods to estimate anticipated inflation.[12]

This study estimates anticipated inflation one quarter ahead by employing a time-series forecast of inflation. This method generates predictions of inflation solely on the basis of its past behavior.[13] The difference between the actual rate of inflation and the rate forecast by the model is interpreted as the empirical counterpart of unanticipated inflation, π^u. Because the real price of bank stock is expected to be inversely related to unanticipated inflation, the coefficient of π^u should be negative.

Anticipated inflation, π^*, and changes in the real price of bank stock are theoretically unrelated; consequently, the coefficient of this variable should be zero. Changes in anticipated inflation change interest rates,

[12]See Hafer and Hein (1985).

[13]Roughly, the technique accounts for the past pattern of inflation by estimating a model that provides a description of the process that generated the observed series. Past observations of inflation are then used along with the information contained in the time-series model to forecast inflation one period ahead. For further discussion of time-series models and their properties, see Pindyck and Rubinfeld (1981), pp. 469–573, especially pp. 469–70 and 493–97. For further discussion of the model employed here, see appendix 2.

however, and these interest rate changes are expected to be inversely related to changes in stock prices. Estimates of the changes in anticipated inflation are obtained directly from the inflation forecasts.[14]

The Business Cycle

Real income growth was included as an explanatory variable to control for the effect of the business cycle on bank earnings. Business expansions increase the real quantity of bank loans, securities and deposits, which is thought to have a positive impact on the expected earnings stream. The empirical counterpart of real income used in the regressions is gross national product (GNP) divided by the GNP deflator. The expected sign of the coefficient of this term is positive.

The Interest Rate

The prices of bank stocks are expected to be related to changes in the interest rate. The interest rate will vary with changes in the *ex ante* real interest rate, changes in income tax laws, changes in risk premiums and changes in anticipated inflation. Since the interest rate includes all of these factors, changes in it cannot be readily attributed to the effect of any one of them. The qualitative effect of a change in the interest rate on stock prices, however, is the same regardless of the source. The expected sign of the coefficient of interest rate changes is negative.

Since this paper focuses on the effect of inflation, the following estimates attempt to isolate the effect of a change in anticipated inflation. As mentioned above, an estimate of anticipated inflation, π^*, is produced by the time-series forecast of inflation. When this estimate is subtracted from the nominal interest rate, the residual is an estimate of the nominal interest rate excluding anticipated inflation. Consequently, changes in the estimate of anticipated inflation, $\Delta\pi^*$, and changes in the difference between the nominal rate and the estimate of anticipated inflation, $\Delta(i - \pi^*)$, can be included separately in the regression equation.[15] The expected sign of each of these terms is negative.

Controlling for Problem Loans

In addition to the above variables, the estimated equations include a dummy variable to control for the effect that recent Latin American loan problems have had on bank stock prices. During the early part of 1982, it became apparent that certain Latin American countries would have difficulty honoring their obligations to U.S. banks. In October and November 1982, the central bank of Brazil began borrowing heavily from the Exchange Stabilization Fund of the U.S. Treasury; Mexico began drawing heavily on its swap arrangement with the Federal Reserve System in April of the same year. News reports on the extent of the problem continued to surface for about three quarters. The period dummied begins in the first quarter of 1982 and extends through the third quarter of 1982, when it became evident that the U.S. government would take an active role in resolving the problem.[16] The expected sign of the dummy is negative.

The Estimates

Table 5 presents the regression results. Estimate 1 examines the effect of inflation on an index of the real share prices of banks located outside New York City. Estimate 2 does the same thing for New York City banks.[17]

The signs of the estimated coefficients are as expected. The estimates indicate that unanticipated inflation and changes in the anticipated rate of inflation are inversely related to changes in the real price of bank stock. As expected, the estimated coefficient of anticipated inflation is not significantly different from zero in a statistical sense.

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[14]Changes in the interest rate are expected to be positively related to changes in anticipated inflation. To check this, changes in the Aaa bond rate, ΔR, and changes in the 3-month Treasury bill rate, ΔRS, were regressed on the estimate of the change in inflation expectations. The results are presented below.

$$\Delta R_t = .09 + .13\Delta\pi^*_t \quad (1.93)\ (3.03)^* \qquad \Delta RS_t = .06 + .36\Delta\pi^*_t \quad (.58)\ (3.71)^*$$

$$DW = 1.65 \qquad DW = 1.79$$

$$R^2 = .10 \qquad R^2 = .14$$

Although both coefficients are less than one, they are both positive and significantly different from zero. The estimated coefficient of $\Delta\pi^*$ is larger in the equation for the short-term interest rate, which suggests that the inflation forecast used here is a better estimate of short-run expectations.

[15]Actually, the data entry is one plus the difference between the nominal rate and anticipated inflation. This is necessary because the difference is negative in some quarters during 1971, 1975 and 1976. See Brown and Santoni (1981) for a discussion of some problems associated with this method of separating the nominal rate into its various components.

[16]On February 2, 1983, the chairman of the Federal Reserve Board addressed the House Committee on Banking, Finance and Urban Affairs regarding the problem and measures to deal with it. See Volcker (1983).

[17]This was done because Standard and Poor's reports the data this way.

Table 5

Estimating the Effect of Inflation on the Price of Bank Shares, Sample Period: I/1962–IV/1985

Estimate 1:

$$\Delta LnBK/P = \underset{(.47)}{-4.29} + \underset{(2.21)^*}{1.79}\Delta Lny - \underset{(3.91)^*}{4.72}\Delta Ln(1+i-\pi^*) - \underset{(3.19)^*}{1.48}\pi^u + \underset{(.15)}{.05}\pi^* - \underset{(3.01)^*}{.12}\Delta Ln\pi^* - \underset{(2.64)^*}{11.75}\,DUM$$

RSQ = .34
DW = 1.68

Estimate 2:

$$\Delta LnBKNY/P = \underset{(.64)}{5.94} + \underset{(1.33)}{1.10}\Delta Lny - \underset{(4.44)^*}{5.51}\Delta Ln(1+i-\pi^*) - \underset{(2.81)^*}{1.34}\pi^u + \underset{(.99)}{.35}\pi^* - \underset{(2.97)^*}{.12}\Delta Ln\pi^* - \underset{(1.32)}{6.05}\,DUM$$

RSQ = .31
DW = 1.74

where:
BK/P = the Standard and Poor's index of the real share prices of banks located outside New York City
BKNY/P = the Standard and Poor's index of the real share prices of New York City banks
y = Real Gross National Product
i = the corporate Aaa bond rate
π^u = unanticipated inflation
π^* = anticipated inflation
DUM = 1 during I/1982–III/1982 and zero otherwise

NOTE: Absolute values of t-scores appear in parentheses. * = significantly different from zero at the 5 percent level.

The coefficient of the dummy variable has the expected sign in both estimates but is not significant in estimate 2. In the case of estimate 1, the coefficient is significant and its point estimate is fairly large, suggesting that the growth in real stock prices was about 12 percent lower, on average, during the first three quarters of 1982, other things the same. This may be somewhat misleading since the confidence interval for this coefficient ranges from −2.9 to −20.7.

Implications for Banks

The average forecast of inflation (π^*) generated by the time-series model during 1984 was about 4.0 percent. This fell to about 3.5 percent during 1985, resulting in a 13.5 percent drop in anticipated inflation ($\Delta Ln\pi^*$). The table 5 estimates suggest that this raised the real stock prices of the banks in the sample by about 1.6 percent ($= -13.5 \times -.12$). In addition, the decline in the actual rate of inflation exceeded the decline in anticipated inflation. As a result, unanticipated inflation averaged about −.85 percent in 1985, raising the real stock prices of banks by an additional 1.2 percent ($= -.85 \times -1.4$). In sum, the real stock prices of banks increased by about 3.0 percent, ceteris paribus, as a consequence of the fall in anticipated inflation in 1985 and because the actual rate of inflation in 1985 was even lower than anticipated.

CONCLUSION

This paper examines the effect that inflation has on the share prices of commercial banks. The results indicate that the real share prices of banks are inversely related to both unanticipated inflation — that is, deviations in the realized rate of inflation from its anticipated rate — and changes in anticipated inflation. Contrary to some claims, this evidence indicates that bank shareholders have benefited from the recent decline in the rate of inflation and that any unexpected resurgence of inflation would be harmful.

REFERENCES

Alchian, Armen A., and William R. Allen. *Exchange and Production: Competition, Coordination and Control,* 2nd ed. (Wadsworth Publishing Company, Inc., 1977), pp. 490–94.

Alchian, Armen A., and Reuben A. Kessel. "Effects of Inflation," *Economic Forces at Work* (Liberty Press, 1977a), pp. 363–96.

———— and ————. "Redistribution of Wealth Through Inflation," *Economic Forces at Work* (Liberty Press, 1977b), pp. 397–412.

Bierwag, G. O., George G. Kaufman and Alden Toevs. "Duration: Its Development and Use in Bond Portfolio Management," *Financial Analysts Journal* (July/August 1983), pp. 15–35.

Brown, W. W., and G. J. Santoni. "Unreal Estimates of the Real Rate of Interest," this *Review* (January 1981), pp. 18–26.

"Corporate Earnings Uneven," *New York Times*, November 4, 1985.

Darby, Michael R. "The Financial and Tax Effects of Monetary Policy on Interest Rates," *Economic Inquiry* (June 1975), pp. 266–76.

Fama, Eugene F. "Efficient Capital Markets: A Review of Theory and Empirical Work," *Journal of Finance*, Papers and Proceedings (May 1970), pp. 383–417.

Fisher, Irving. *Appreciation and Interest* (Augustus M. Kelley, 1965), pp. 1–100.

————. *The Theory of Interest* (Kelley and Millman, 1954).

————. *The Rate of Interest* (The Macmillan Company, 1907).

Hafer, R. W., and Scott E. Hein. "On the Accuracy of Time-Series, Interest Rate, and Survey Forecasts of Inflation," *The Journal of Business* (October 1985), pp. 377–98.

Kessel, Reuben A. "Inflation-Caused Wealth Redistribution: A Test of a Hypothesis," *American Economic Review* (March 1956), pp. 128–41.

Keynes, J. M. *A Tract on Monetary Reform* (Macmillan and Company, 1923).

Kochin, Levis. "The Term Structure of Interest Rates and Uncertain Inflation" (University of Washington, 1981; processed).

Maisel, Sherman J., and Robert Jacobson. "Interest Rate Changes and Commercial Bank Revenues and Costs," *Journal of Financial and Quantitative Analysis* (November 1978), pp. 687–700.

Pindyck, Robert S., and Daniel L. Rubinfeld. *Econometric Models and Economic Forecasts*, 2nd ed. (McGraw-Hill Book Company, 1981), pp. 469–573.

Samuelson, Paul A. "The Effect of Interest Rate Increases on the Banking System," *American Economic Review* (March 1945), pp. 16–27.

Santoni, G. J. "Interest Rate Risk and the Stock Prices of Financial Institutions," this *Review* (August/September 1984), pp. 12–20.

————, and Courtenay C. Stone. "Navigating Through the Interest Rate Morass: Some Basic Principles," this *Review* (March 1981), pp. 11–18.

"The Shaky Credit Structure." *Washington Post*, November 4, 1985.

Volcker, Paul A. *Statement Before the Committee on Banking, Finance and Urban Affairs, House of Representatives*, February 2, 1983.

APPENDIX 1
Some Banking Arithmetic

In large part, a bank's expected stream of net revenue is generated by its holdings of nominal assets and liabilities. These are its loans, L, which earn the market interest rate, i_m, and its deposits, D, on which interest, i_D, is paid. In addition, owners have invested capital, I, of which a fraction, α, must be held as non-interest-earning reserves against deposits, and the remaining fraction, $(1 - \alpha)$, is held in either nominal or real assets that are expected to yield the market rate, i_m. The following assumes that this remainder is held entirely in net real assets. The expected stream of net revenue, R, is given in equation 1:

$$(1)\ R = i_m L - i_D D + i_m(1 - \alpha)I.$$

If the required reserve ratio is ρ, required reserves are $\rho D = \alpha I$. The quantity of loans and deposits the bank can generate are $L = D = \alpha I/\rho$. In equilibrium, the expected revenue stream of the bank must equal the alternative stream of earnings that could be obtained by investing the capital at the market interest rate. This is shown in equation 2:

$$(2)\ R = i_m L - i_D D + i_m(1 - \alpha)I = i_m \alpha I + i_m(1 - \alpha)I.$$

The capital value of the bank, K, is shown in equation 3:

$$(3)\ K = \frac{R}{i_m} = \alpha I + (1 - \alpha)I = I.$$

Equation 3 expresses the capital value of the bank as the present value of the stream of expected revenue. In equilibrium, K = I. If K were greater than I, resources would be attracted to banking since the capital value of forming a bank would exceed the opportunity cost. If K were less than I, resources would leave the industry.

The Equilibrium Interest Rate on Bank Deposits

Substituting ρD for αI in equation 2 and noting that D = L, the equilibrium interest rate on bank deposits is given in equation 4:

$$(4)\ i_D = (1 - \rho)i_m.$$

Banks as Net Creditors in Nominal Assets

Net nominal assets, NNA, are nominal assets minus nominal liabilities. The bank's nominal assets are the sum of its loans and reserves, while the bank's deposits are its nominal liabilities. Assuming equilibrium, these are given in equation 5:

$$(5)\ NNA = L + \rho D - D = \rho D.$$

Under these assumptions, the bank is a net creditor in nominal assets to the extent of its reserve holdings.

APPENDIX 2
A Time-Series Forecast of Inflation

While the initial observation for the regressions reported in the text is first quarter 1962, the data period used to develop the forecast of inflation (as measured by the GNP deflator) extends back to first quarter 1948. A backward extension is necessary to get the forecasting model started.

Since the period covered is quite long, a rough check of the data was made to determine if the process that generated the time series changed materially over the period I/1948-IV/1985. To do so, a model was first estimated for I/1948-IV/1965 and these results were compared with the results obtained from estimates for I/1966-IV/1985. The GNP deflator appears to be a second-order homogeneous process that can be modeled as ARIMA (0, 2, 1). The estimated models for the two periods are reported below. Calculated t-statistics appear in parentheses, and B is a backward shift operator, i.e., $(1\text{-}B)\ X_t = X_t - X_{t-1}$.

I/1948-IV/1965

$$\Delta^2 LnP_t = -.107 + (1 - .49B)e_t$$
$$\quad\quad\quad\;\; (.58) \quad\quad\quad (4.73)$$

Chi-square (2, 24) = 16.07

I/1966-IV/1985

$$\Delta^2 LnP_t = .003 + (1 - .48B)e_t$$
$$\quad\quad\quad\;\; (.03) \quad\quad\quad (4.70)$$

Chi-square (2, 24) = 26.63

A model was then estimated for the period I/1948-IV/1961, and a forecast of inflation for I/1962 was made. The difference between the realized inflation rate for I/1962 and this forecast is interpreted as the empirical counterpart of π^u.

The forecast for the next quarter, II/1962, is generated by adding the realized inflation rate for I/1962 to the data and re-estimating the model through I/1962 and proceeding as above. The process was repeated for each quarter through IV/1985.