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SOURCE OF EXOGENEOUS SHOCKS, INFLATION, REAL ACTIVITY, AND COMMON STOCK RETURNS

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Abstract

This study examines the relation between common stock returns and inflation during the 1947-1983 period. This sample period includes periods of significant monetary shocks, and hence provides a setting to contrast the predictions of different hypotheses for the relations between real activity, inflation, and common stock returns. The evidence indicates that dominant exogenous shocks to the economy can come from not only the investment opportunity set but also from other sources such as monetary and fiscal governmental policy.

I-Introduction

In the financial economics literature, recent studies by Bodie (1976), Nelson (1976), Fama and Schwert (1977), and Fama (1981), among others, document a significantly negative relation between common stock returns and expected and unexpected inflation for the post-1953 period.[1] A negative relation between contemporaneous common stock returns and unexpected inflation is puzzling since it seems to contradict the neutrality of inflation on real economic activity. A negative relation between ex-ante expected inflation and common stock returns is even more puzzling since it contradicts the Fisher (1930) relation which states that nominal stock returns should equal the real returns plus the expected inflation.[2]

Nelson (1979) and Fama (1981) offer an explanation for the negative relation between expected and common stock returns. They argue that exogeneous negative shocks to real activity decreases the demand for money since the transaction demand for money is positively related to real activity. The decrease in demand for money in turn leads to an increase in the price level. At the same time, common stock prices anticipate the decline in real activity and decline. Consequently, an exogeneous negative shock to future real activity simultaneously causes both a decline in common stock prices and an increase in the price level of goods and services, thereby resulting in a spurious negative relation between inflation and common stock returns. Fama (1982) and Fama and Gibbons (1982) present evidence that is consistent with this explanation.

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[1] Also see, Lintner (1975), Jaffe and Mandelker (1976), Schwert (1981), and Gultekin (1983).

[2] There is further problem since it appears that stock prices do not reflect publicly available information about expected inflation. See Schwert (1981).

Geske and Roll (1983) provide a similar explanation for the observed negative relation between common stock returns and inflation, using the link between governmental budget constraint and cyclical nature of deficits. They argue that an exogeous negative shock to future real activity increases government deficit, since government revenues tend to decline more than the expenditures in recessions. If the Federal Reserve chooses to monetize the entire deficit (by following a countercyclical monetary policy), then the supply of money is expanded, which leads to an increase in the price level. At the same time, the common stock prices decline in anticipation of the decline in future real activity. Consequently, higher inflation is again associated with a decline in common stock prices. If the government chooses to monetize only part of the decifit and borrow the remainder, Geske and Roll hypothesize an increase in the real interest rate. Higher real rate is expected to further lower stock prices and at the same time increase the nominal interest rate, again resulting in observed negative relations between stock returns and expected inflation measured by the nominal interest rate.[3]

Alternative explanations for the relation between inflation and real activity differ on the source of the dominant exogeneous shocks to the economy. For instance, in Friedman (1968), Lucas (1972), and Barro (1978) unanticipated money provides the dominant source of shocks to the economy and affects real activity. Friedman (1968) argues that unanticipated changes in

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3 The money demand explanations by Nelson (1979) and Fama (1981) and the deficit-money supply explanation by Geske and Roll (1983) do not conflict with each other, as these studies assume that exogeneous shocks to real activity provide the dominant source of shocks to the economy. Kaul (1986) examines the relation between inflation and common stock returns during 1926-1940 and 1953-1983 periods and concludes that both money demand and money supply effects are responsible for the relation between inflation and common stock returns.

money lead to temporary changes of opposite sign by fooling the market participants. When market participants understand the implications of the policy changes, the initial effects on the economy are reversed and the economy reverts back its natural rate of output and employment.[4] Similarly, Barro (1977,1978) shows that unanticipated monetary shock are associated with decreases in unemployment and increases in output. Hence, allowing unanticipated changes in monetary policy to provide shocks to the economy in addition to shocks to real activity can generate both positive as well as negative associations between inflation and real activity.

This paper examines the relation between inflation and common stock returns during 1947-1983. The sample period includes the subperiod 1947-1952 which has been omitted from analysis in previous studies and corresponds to a period of monetary shocks and associated inflation. Including periods of substantial monetary shocks is expected to provide a more general view of the relation between inflation and real activity. Hence, the period of 1947-1983 is examined to contrast the Fama (1981) and Geske and Roll (1983) viewpoint where the dominant shocks to the economy come from real activity with those of Friedman (1968), Lucas (1972), Barro (1977,1978) and others where the dominant shocks come from the monetary policy.

The paper is organized as follows. Section 2 of the paper provides information on data sources and sample characteristics. The empirical evidence on the relation between real activity, inflation, and common stock returns for different subperiods is presented in Section 3. Section 4 of the paper contains the conclusions and implications.

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4 Mundell (1963) and Tobin (1965) posit that the real interest rate decreases with a sustained increase in money which in turn lowers the required interest rate on real investments and leads to an increase in real activity. Alternatively, Stulz (1985) presents a model where the expected real interest is affected through the decreases in wealth associated with inflation.

II-Data and Sample Characteristics

The price data used in this study come from the Citibase databank, covering the period from January 1947 to December 1983. Data are monthly and quarterly data are generated from the monthly data. Inflation is computed using both the Consumer Price Index and the Producer Price Index. The real economic activity is measured by Industrial Production Total Index, obtained from the Cuurent Survey of Business. Money is measured by a variety of measures including adjusted monetary base which is currency held by the public plus bank reserves, and the currency component of the adjusted base money.[5] The Industrial Production Total Index, currency held by the public, and the adjusted monetary base series are all seasonally unadjusted. All returns computed from the price series are simple returns.

Quarterly data is chosen for analysis as a compromise between monthly and annual data. Monthly data provide more observations but exhibit troublesome seasonalities. Furthermore nonsynchronous reporting problems are more serious with the monthly data. Annual data ameliorate the seasonality and nonsynchronous reporting problems at the cost of substantial reduction in the number of observations. Quarterly data provide a compromise between these two extremes.

The common stock returns are obtained from the monthly files of the Center for Research in Security Prices (CRSP) of the University of Chicago. Common stock returns are measured both by the equally weighted and the value-weighted indices of the stock returns to New York Stock Exchange and The American Stock Exchange firms. The data on 1-month and 3-month Treasury Bills

[5] I thank Gautam Kaul for making the adjusted monetary base and the industrial production data available.

are obtained from the Wall Street Journal as the end-of-month prices and checked against Ibbotson and Sinquefield (1982) studies. The returns on Treasury Bills are computed by using the mean of the bid and ask prices as the initial price.

Table 1 shows the sample characteristics of data during the four subperiods of analysis; 1947-1952, 1953-1959, 1960-1976, and 1977-1983. The monthly CPI inflation is 0.31%, 0.11%, 0.34%, and 0.69% for the four subperiods respectively. Hence, CPI inflation first decreases, and then increases sharply over the time periods examined. The growth rate of PPI series closely follows the growth rate of CPI series. The return on 1-month Treasury Bills during the four subperiods are 0.09%, 0.16%, 0.37%, and 0.77% respectively. Hence, the ex-post real interest rate on 1-month Treasury Bills is negative during the first subperiod and positive during the other subperiods. While an expected negative real interest rate on Treasury Bills seems surprising, most of the Treasury Bills during this subperiod were purchased by the Federal Reserve as part of the government policy of paying for the war effort.

Table 1 also shows the return on the market indices. The returns on the value-weighted market index are 0.89%, 1.25%, 0.33%, and 0.48% for the four subperiods respectively. Hence, subtracting the CPI inflation rate, the ex-post real interest on the value-weighted market index is positive during the first two subperiods, and negative during the next two subperiods. The realized returns on the equally-weighted market index are 0.77%, 1.30%, 0.55%, and 1.23% for the four subperiods, respectively. Thus, the ex-post real interest rate on the equally-weighted index is positive in each subperiod.

Table 1

Monthly growth rate of Consumer Price Index and Producer Price Index, return on 1-month Treasury Bills, and the return on equally-weighted and value-weighted market index during February 1947 to December 1952, January 1953 to December 1959, January 1960 to December 1976, and January 1977 to June 1983 periods.

Monthly Return on	Time periods			
	2/47-12/52	1/53-12/59	1/60-12/76	1/77-6/83
Consumer Price Index	0.31%	0.11%	0.34%	0.69%
Producer Price Index	0.25%	0.10%	0.34%	0.62%
1-month Treasury Bill	0.09%	0.16%	0.37%	0.77%
Value-weighted market index	0.89%	1.25%	0.33%	0.48%
Equal-weighted market index	0.77%	1.30%	0.55%	1.23%
Number of months	71	84	204	78

III-Empirical Evidence

One of the reasons for omitting the period from 1947 to 1952 from analysis has been that the Consumer Price Index series prior to 1953 is not as good as the post-1953 data, since the components that comprise the Consumer Price Index (CPI) series have been expanded and sampled more frequently in 1953. However, this does not mean that there is no information in the CPI series about inflation before 1953. Since the return on Treasury Bills do not track the expected inflation before 1953 due to the pegging, this paper attempts to extract a measure of expected inflation from the time series of CPI inflation using univariate time series models.

The next set of tests examines the information content of CPI and PPI series by examining whether the expected inflation derived from univariate time series models can predict the actual inflation. To obtain a model of expected and unexpected inflation, a univariate time series model is fitted to the Consumer Price Index (CPI) and the Producer Price Index (PPI) separately for 1947-1952, 1953-1959, 1960-1976, and 1977-1983 subperiods using Box and Jenkins (1976) methods.

Table 2 shows the univariate time series models of expected inflation using quarterly CPI and PPI series for each of the four subperiods. With the exception of 1960-1976 subperiod PPI model, the autoregressive models shown result in good fits as measured by low autocorrelation of the residuals. For the 1960-1976 subperiod, a first order integrated moving average model, IMA(1,1) results in a good fit for the PPI inflation. For all of the models, the Box-Pierce statistics for the joint autocorrelation of the residuals is insignificant at the 10% level at lags 6, 12, and 18. Hence, the models shown in table 2 exhibit good fits.

Table 2

Univariate time series models of expected inflation at time t, EI_t, using quarterly CPI and PPI series. Inflation at time t is denoted as I_t. The t-statistics of coefficient estimates are shown in parentheses.[a]

No	Period	Model	r1	r2	r3	r4
Panel A:		**Expected inflation models using quarterly CPI data**				
(1)	47/52	$EI_t = \underset{(1.67)}{0.008} + \underset{(1.64)}{0.36}\, I_{t-1} - \underset{(-1.00)}{0.23}\, I_{t-2} + \underset{(1.36)}{0.30}\, I_{t-3}$	.09	.04	.14	-.18
(2)	53/59	$EI_t = \underset{(1.68)}{0.003} + \underset{(1.43)}{0.26}\, I_{t-1} + \underset{(1.80)}{0.33}\, I_{t-3}$	.02	-.03	.11	.00
(3)	60/76	$EI_t = \underset{(1.54)}{0.005} + \underset{(3.93)}{0.42}\, I_{t-1} + \underset{(4.60)}{0.50}\, I_{t-2}$	-.01	.02	.11	.17
(4)	77/83	$EI_t = \underset{(3.00)}{0.017} + \underset{(3.75)}{0.65}\, I_{t-1} - \underset{(-1.99)}{0.41}\, I_{t-2} + \underset{(3.32)}{0.63}\, I_{t-3}$	.09	-.05	.31	.03
Panel B:		**Expected inflation models using quarterly PPI data**				
(1)	47/52	$EI_t = \underset{(0.41)}{0.004} + \underset{(2.64)}{0.51}\, I_{t-1}$	.07	-.07	.01	-.07
(2)	53/59	$EI_t = \underset{(1.22)}{0.002} + \underset{(2.29)}{0.43}\, I_{t-2}$	-.01	-.06	.01	.12
(3)	60/76	$EI_t = \underset{(0.24)}{0.000} + I_{t-1} - \underset{(-4.60)}{0.68}\, u_{t-1}$	-.01	-.04	.04	.08
(4)	77/83	$EI_t = \underset{(2.26)}{0.016} + \underset{(2.61)}{0.44}\, I_{t-1} + \underset{(2.19)}{0.41}\, I_{t-4}$	.04	.36	.07	.32

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a The term u_t denotes the residual at time t and r_k denotes the serial correlation of the residuals at lag k. The approximate standard errors of the serial correlation coefficients are 0.21, 0.19, 0.12, and 0.20 for the four subperiods respectively.

The tests presented in table 3 examine the ability of the expected inflation estimated from the univariate time series models to predict actual inflation in each subperiod, 1947-1952, 1953-1959, 1960-1976, and 1977-1983. For each of the four subperiods, the univariate time series model of expected inflation performs well. In each case, the expected inflation is unbiased as measured by a slope coefficient insignificantly different from 1.0 and an intercept coefficient insignificantly different from 0.0. Furthermore, the residuals are not serially correlated. None of the serial correlation coefficients of the residuals are significant at the 10% level. Also, a single time series model of expected inflation is estimated over the overall period, 1947-1983. While not shown, the measure of expected inflation estimated over 1947-1983 also tracks actual inflation in each subperiod fairly well.

Model (1) in panels A and B of table 3 tests the predictive ability of expected inflation for the 1947-1952 subperiod. The regression coefficient estimate of expected inflation is nearly 1.0, while the standard error of the coefficient is about 0.40. This evidence supports the concern of Fama (1975) that the CPI series before 1953 is less reliable, since the standard errors of the regression are smaller in later subperiods. Also contributing to less reliable expected inflation estimate for the subperiod 1947-1952 is the smaller number of observations. However, comparison of the 1947-1952 subperiod with the 1953-1959 subperiod indicates that the model of expected inflation is not subtantially inferior in the earlier subperiod. Hence, the time series model of expected inflation has considerable predictive ability for the subperiod 1947-1952. Given some degree of confidence about the model of expected inflation in each subperiod, the next set of tests examine the relation between common stock returns, expected and unexpected inflation, and real activity.

Table 3

Regression of actual inflation at time t, I_t, against expected inflation for time t, EI_t made at time t-1, using quarterly CPI and PPI series for each subperiod. The standard errors of coefficient estimates are shown in parentheses.a

No	Period	Model	r1	r2	r3	r4	r5	r6	r8
Panel A: Prediction of actual CPI inflation by time series model of expected CPI inflation									
(1)	47/52	$I_t = 0.000 + 1.00\ EI_t$ (0.005) (0.47)	.09	.04	.14	-.18	-.27	-.28	-.11
(2)	53/59	$I_t = 0.000 + 1.00\ EI_t$ (0.002) (0.40)	.02	-.03	.11	.00	.10	-.22	-.11
(3)	60/76	$I_t = 0.001 + 0.95\ EI_t$ (0.001) (0.08)	-.01	.03	.11	.17	-.01	-.13	-.23
(4)	77/83	$I_t = -0.001 + 1.02\ EI_t$ (0.004) (0.20)	.07	-.06	.32	.03	.18	.06	.03
Panel B: Prediction of actual PPI inflation by time series model of expected PPI inflation									
(1)	47/52	$I_t = 0.001 + 0.99\ EI_t$ (0.005) (0.38)	.07	-.07	.00	-.07	-.24	-.22	.06
(2)	53/59	$I_t = 0.000 + 0.99\ EI_t$ (0.002) (0.44)	-.01	-.06	.01	.12	.10	.04	-.04
(3)	60/76	$I_t = 0.002 + 0.79\ EI_t$ (0.002) (0.14)	.03	-.01	;07	.11	.08	.09	-.10
(4)	77/83	$I_t = -0.001 + 1.02\ EI_t$ (0.005) (0.23)	.02	.35	.07	.32	.04	-.06	-.17

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a The term r_k denotes the serial correlation of the residuals at lag k. The approximate standard errors of the serial correlation coefficients are 0.21, 0.19, 0.12, and 0.20 for the four subperiods respectively.

The relation between common stock returns and expected inflation, unexpected inflation, and changes in expected inflation for the period 1947-1952 are shown in table 4A. For the equally-weighted index of market returns, the relation between expected CPI inflation and common stock returns is negative, while the relation between unexpected CPI inflation and common stock returns is positive. The positive relation is statistically significant at the 5% level using two-tailed tests. Furthermore, changes in expected CPI inflation and common stock returns are also positively associated as shown in model (4). Positive relations between common stock returns and unexpected inflation and changes in expected inflation are contrary to the previously documented negative relations for the period after 1953. Equations (5) through (8) in table 4A examine the relations between common stock returns and the expected inflation, unexpected inflation, and changes in expected inflation using the Producer Price Index (PPI) inflation. In contrast with models (1) through (3), the relation between common stock returns and expected PPI inflation is insignificant, while both the unexpected PPI inflation and changes in expected PPI inflation are again positively related to common stock returns. The significance levels of the PPI inflation are similar to the significance levels of the CPI inflation. All models exhibit low serial correlation of the residuals. In table 4A, none of the serial correlation of the residuals is significant at the 10% level. All tests are also repeated using the value-weighted index of market returns. The results (not shown) using the value-weighted index are similar to the results using the equal-weighted market index in all models.

Table 4A

Regression of quarterly returns to equal-weighted index of market returns, Re on quarterly expected and unexpected CPI inflation, EI_C and UI_C, and changes in expected CPI inflation, DEI_C, as well as expected and unexpected PPI inflation, EI_P and UI_P, and changes in expected PPI inflation, DEI_P, respectively. The time period of analysis is from February 1947 to December 1952, which contains 23 quarters. The t-statistics of coefficient estimates are shown in parentheses.[a]

Model No	Model	r1	r2	r3	r4	r6	r8
(1)	$Re = 0.073 - 4.42\, EI_C$ (2.93) (-1.88)	-.01	-.08	.06	-.07	-.07	.02
(2)	$Re = 0.035 + 2.29\, UI_C$ (2.47) (2.14)	-.04	-.14	.17	.08	.11	-.26
(3)	$Re = 0.073 - 4.42\, EI_C + 2.29\, UI_C$ (3.21) (-2.06) (2.30)	-.08	-.16	.03	.01	-.03	.07
(4)	$Re = 0.038 - 0.42\, EI_C + 3.59\, DEI_C$ (1.11) (-0.12) (1.53)	.01	-.10	.03	.06	-.12	.04
(5)	$Re = 0.034 + 0.14\, EI_P$ (2.03) (0.12)	-.09	-.04	.15	-.05	.00	-.01
(6)	$Re = 0.033 + 1.48\, UI_P$ (2.39) (2.38)	-.08	-.22	.24	-.04	.05	-03
(7)	$Re = 0.032 + 0.15\, EI_P + 1.48\, UI_P$ (2.12) (0.15) (2.33)	-.08	-.21	.24	-.05	.06	-.03
(8)	$Re = 0.024 + 1.67\, EI_P + 3.19\, DEI_P$ (1.47) (1.33) (2.53)	-.06	-.22	.26	-.02	.11	-.08

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a The variable r_k denotes the serial correlation coefficient of the residuals at lag k. The standard error of the correlation coefficients is approximately 0.21.

The relation between expected inflation, unexpected inflation, and changes in expected inflation and common stock returns for the subperiods 1953-1959, 1960-1976, and 1977-1983 are shown in table 4B. Models (1) and (3) in table 4B show that for the subperiod 1953-1959 unexpected CPI and PPI inflation measured from the univariate time series models are marginally negatively related to common stock returns. Expected inflation for both CPI and PPI measures are not related to the common stock returns. Models (4) through (6) shows strong negative relation between unexpected inflation and changes in expected inflation and common stock returns for the period 1960-1976. The magnitudes of the coefficient estimates of unexpected inflation range from 0.37 to -29.42. The t-statistics for the regression coefficient of unexpected inflation range from 0.20 to -5.05. Models (7) through (9) indicate that for the period 1977-1983 the relation between inflation and common stock returns is only marginally negative. Hence, for the subperiods 1953-1959, 1960-1976, and 1977-1983 unexpected inflation and changes in expected inflation are negatively related to common stock returns, while the expected inflation as measured by a time series model is not significantly related to common stock returns.[6]

The next set of tests examine the relation between real activity and inflation. The two groups of hypotheses examined in this paper have differing predictions for the relation between inflation and real activity. If the dominant shocks come from real activity, then as Fama (1981) explains, the relation between real activity and inflation is expected to be negative. On the other hand, if the dominant shocks come from monetary policy, then the

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[6] Fama and Gibbons (1984) compare the forecasting properties of the time series model of expected inflation with that obtained from the Treasury Bill models and conclude that the forecasting ability of these models of expected inflation are about the same.

Table 4B

Regression of quarterly returns to equal-weighted index of market returns, Re on quarterly expected CPI inflation EI_C, unexpected CPI inflation, UI_C, and changes in expected CPI inflation DEI_C as well as expected and unexpected PPI inflation EI_P and UI_P, respectively. The time period of analysis is from January 1953 to June 1983. The t-statistics of coefficient estimates are shown in parentheses.[a]

Model No	Model	r1	r2	r3	r4	r6	r8
Time period: January 1953 to December 1959.							
(1)	$Re = 0.065 - 6.24\ EI_C - 5.57\ UI_C$ (2.94) (-1.11) (-2.00)	.20	-.05	-.06	-.26	-.24	.12
(2)	$Re = 0.054 - 3.43\ EI_P - 3.55\ UI_P$ (2.94) (-0.69) (-1.59)	.29	.04	-.07	-.30	-.35	.15
(3)	$Re = 0.070 - 8.16\ EI_C - 4.60\ DEI_C$ (2.62) (-1.18) (-0.62)	.38	-.03	-.16	-.27	-.26	.07
Time period: January 1960 to December 1976.							
(4)	$Re = 0.042 - 0.56\ EI_C - 14.84\ UI_C$ (1.83) (-0.29) (-4.72)	-.16	-.01	-.14	.00	.03	-.13
(5)	$Re = 0.043 - 1.25\ EI_P - 3.15\ UI_P$ (2.19) (-0.97) (-2.87)	-.17	-.08	-.13	.16	-.04	-.03
(6)	$Re = 0.048 - 1.60\ EI_C - 29.42\ DEI_C$ (2.09) (-0.83) (-5.05)	.18	-.04	.01	-.05	.12	-.09
Time period: January 1977 to June 1983							
(7)	$Re = 0.073 - 0.70\ EI_C - 4.83\ UI_C$ (1.34) (-0.29) (-1.93)	.10	.03	-.11	-.11	-.28	.04
(8)	$Re = 0.100 - 2.08\ EI_P + 0.37\ UI_P$ (2.18) (-0.97) (0.20)	.00	-.07	-.01	-.22	-.19	.09
(9)	$Re = 0.133 - 3.64\ EI_C - 5.95\ DEI_C$ (2.08) (-1.28) (-2.31)	.10	.03	-.10	-.16	-.20	-.08

a The variable r_k denotes the serial correlation coefficient of the residuals at lag k. The standard error of the correlation coefficients is approximately 0.19, 0.12, and 0.20 for the three subperiods, respectively.

natural rate hypothesis as stated by Friedman (1968) predicts a temporary positive relation between inflation and real activity. A third possibility is the Fisher (1930) relation which simply states that the nominal stock returns equals real stock returns plus expected inflation. Since expected inflation is assumed not to affect the real stock returns, the nominal stock returns are expected to vary directly with expected inflation. Consequently, a positive relation between inflation and stock returns is also consistent with no relation between inflation and real activity.

Table 5 shows the regression of CPI inflation on the growth rates of current and future real activity, as well as the growth rates of adjusted monetary base. Both the growth rate of real activity and growth rate of adjusted monetary base show strong annual seasonality. Furthermore, seasonal variation in real activity dominates other sources of variation and it is mostly unrelated to variation in inflation. Following Fama (1982), a seasonal adjustment is obtained by using the annual growth rates. Hence, GRA_t is the growth rate of real activity for the four quarters ending in quarter t. Similarly, M_t is the growth rate of adjusted monetary base for the four quarters ending in quarter t.

Models (1) and (2) in table 5 examine the relation between inflation and real activity for the subperiod 1947-1952. The relation between inflation and real activity is positive and statistically significant at the 1% level. The residuals are not significantly serially correlated. Similar to the other studies for the post-1953 periods, the relation between inflation and real activity is mostly negative as shown in models (3) through (6) of table 5. The negative relations between inflation and real activity are most pronounced for the subperiod 1960-1976. Models (7) and (8) examine the subperiod of 1977-1983 which is also characterized by relatively high inflation. In models (7) and (8) the relation between inflation and real activity is mixed.

Table 5

Regression of CPI inflation I, against adjusted monetary base M, and growth rate of real activity GRA. The time period of analysis is from January 1947 to June 1983. The t-statistics of coefficient estimates are shown in parentheses.a

Model: $I_t = a_0 + a_1 Mt + a_2 M_{t-1} + a_3 GRA_t + a_4 GRA_{t+1}$

No	Constant	Mt	Mt-1	GRAt	GRAt+1	r1	r2	r3	r4	r6	r8
Time period: January 1947 to December 1952.											
(1)	0.0018	0.021		0.118	-0.015	-.12	-.42	-.05	.11	-.12	-.13
	(0.60)	(0.18)		(2.41)	(-0.32)						
(2)	0.0015	-0.829	0.933	0.147	-0.021	-.10	-.45	.10	.13	-.07	-.06
	(0.65)	(-3.38)	(3.69)	(3.98)	(-0.60)						
Time period: January 1953 to December 1959.											
(3)	0.0042	-0.025		0.025	-0.041	.20	.07	.41	.22	-.03	.00
	(2.56)	(-0.24)		(1.43)	(-2.32)						
(4)	0.0051	0.162	-0.247	0.033	-0.045	.30	.02	.17	.24	-.09	-.11
	(3.24)	(1.26)	(-2.18)	(1.97)	(-2.77)						
Time period: January 1960 to December 1976.											
(5)	-0.0003	0.229		0.015	-0.065	.33	.36	.09	.08	-.09	-.21
	(-0.19)	(7.77)		(0.74)	(-3.38)						
(6)	-0.0006	0.002	0.235	0.008	-0.060	.39	.32	.06	.03	-.11	-.23
	(-0.33)	(0.02)	(2.46)	(0.43)	(-3.19)						
Time period: January 1977 to June 1983.											
(7)	-0.0066	0.360		0.173	-0.193	.30	.04	.30	.25	-.19	-.13
	(-0.41)	(1.69)		(2.78)	(-2.74)						
(8)	-0.0327	0.947	-0.221	0.143	-0.225	.23	-.35	-.09	.33	-.26	-.06
	(-2.25)	(3.78)	(-0.97)	(2.86)	(-3.98)						

a The variable r_k denotes the serial correlation coefficient of the residuals at lag k. The standard error of the correlation coefficients is approximately 0.21, 0.19, 0.12, and 0.20 for the four subperiods respectively.

A deliberately procyclical monetary policy whereby the monetary targets are set in response to anticipated changes in future real activity can also produce a positive relation between inflation and real activity as well as between inflation and common stock returns. If the government responds to an anticipated positive shock to future real economic activity by increasing the money supply, then positive shocks to real economic activity will be associated with positive inflation, if the increase in money supply exceeds the money demand at the existing price level. Since stock prices will also rise in anticipation of the rise in real activity, common stock returns and inflation will also be positively related.

The tests shown in table 6 examine the relation between real economic activity and money supply. As a measure of real economic activity the annual growth rate of industrial production is used. The money supply is measured by the annual growth rate of the adjusted monetary base which is currency held by the public plus the reserves. The currency component of the monetary base is examined separately. Using quarterly data, the models (1) through (3) in table 6 show that during the 1947-1952 period, there is only a marginally positive relation between money supply and the real economic activity. Including a term for the future real activity destroys this marginally positive relation. A likely reason for the demise of the positive relation is the high degree of multicollinearity between GRA_t and GRA_{t+1}, as they share nine months of common data. For the other subperiods, 1953-1959, 1960-1976, and 1977-1983, the evidence suggests that there is no relation between money supply and current and future real economic activity. While not shown, the tests using currency component of the base money alone also produce no significant relation between money supply and the real economic activity. The lack of very strong positive relations between money supply and real activity

Table 6

Regression of the growth rate of adjusted monetary base Mt, against past growth rates of adjusted monetary base and growth rate of real activity GRAt. The time period of analysis is from January 1947 to June 1983. The t-statistics of coefficient estimates are shown in parentheses.a

No	Constant	Mt-1	Mt-2	GRAt	GRAt+1	r1	r2	r3	r4	r6	r8
Time period: January 1947 to December 1952.											
(1)	0.0010	0.903	0.073	0.033	0.001	-.07	.01	-.07	-.13	-.28	-.03
	(0.40)	(3.47)	(0.27)	(0.86)	(0.01)						
(2)	0.0010	0.902	0.073	0.033		-.07	.02	-.07	-.13	-.28	-.04
	(0.44)	(3.85)	(0.29)	(1.52)							
(3)	0.0004	0.965		0.034		-.04	.18	-.06	-.18	-.27	-.10
	(0.16)	(11.68)		(1.60)							
Time period: January 1953 to December 1959.											
(4)	0.0038	0.404	0.234	-0.006	0.029	-.16	.06	-.09	-.25	-.04	.13
	(1.59)	(2.11)	(1.32)	(-0.21)	(1.14)						
(5)	0.0057	0.270	0.210	0.023		.04	.06	.23	-.31	-.12	.04
	(2.61)	(1.50)	(1.35)	(0.89)							
(6)	0.0065	0.437		0.019		-.13	.10	.28	-.37	-.10	.12
	(3.00)	(3.26)		(1.20)							
Time period: January 1960 to December 1976.											
(7)	0.0040	1.123	-0.184	-0.029	0.025	-.03	.11	-.10	-.36	-.11	-.08
	(1.86)	(9.17)	(-1.53)	(-1.20)	(1.04)						
(8)	0.0046	1.136	-0.204	-0.007		-.08	.11	-.07	-.38	-.14	-.07
	(2.16)	(9.42)	(-1.71)	(-0.49)							
(9)	0.0043	0.939		-0.006		.15	.10	-.14	-.42	-.14	-.03
	(2.01)	(25.84)		(-0.46)							
Time period: January 1977 to June 1983.											
(10)	0.0244	0.889	-0.207	-0.049	0.063	-.12	.17	.16	-.31	-.35	-.12
	(1.90)	(3.70)	(-0.90)	(-1.01)	(1.26)						
(11)	0.0200	1.065	-0.320	0.003		-.08	.12	.12	-.23	-.38	-.12
	(1.55)	(5.43)	(-1.43)	(0.08)							
(12)	0.0104	0.878		-0.018		.18	.15	.11	-.16	-.32	-.13
	(0.93)	(5.87)		(-0.62)							

a The variable r_k denotes the serial correlation coefficient of the residuals at lag k. The standard error of the correlation coefficients is approximately 0.21, 0.19, 0.12, and 0.20 for the four subperiods respectively.

in table 6 suggests that for the subperiod 1947-1952, the governmental monetary policy is not set in reaction to changes in real activity.

To contrast the relative importance of dominant shocks to the economy for different periods, the relation between the real interest rates and real economic activity is examined. Fama and Gibbons (1982) point out that when there are exogeneous shocks to real economic activity, changes in economic activity are associated with changes in expected real interest rate which have the same sign. For instance, when an exogeneous expansion in investment opportunity set makes additional investments profitable, resources have to attracted away from consumption into investment. To induce resources into investment, the expected real interest rate would have to rise, thereby producing a positive relation between the expected real interest rate and real activity. On the other hand, if the dominant shock comes from the monetary policy as in Friedman (1968), then an unanticipated monetary expansion would be associated with a temporary decline in real interest rate and a temporary expansion in output. As the expectations of inflation catch up with the change in monetary policy, initial changes would be reversed. The real interest rate would rise toward its natural rate while the rate of output would fall toward its natural rate. Accordingly, the relation between real interest rate and real activity would be expected to be negative.

To examine the relation between real interest rates and real activity, estimates of expected real interest rates are necessary. Unfortunately, the interest rate on Treasury Bills during 1947-1952 is not a market determined rate of interest. Hence, the real rate of interest on Treasury Bills need not equal the real rate of interest on other financial assets. Nevertheless, the real rate of interest on Treasury Bills is expected to capture the attractiveness of Treasury Bills relative to common stocks. A fall on the real rate of interest for Treasury Bills is expected to lead to some shifts of funds out of Treasury Bills into common stocks, thereby also lowering the real rate of interest for common stocks as well. Hence, the real rates of interest for Treasury Bills and other financial assets are expected to be positively correlated rather than equal to each other.

Estimates of expected real rate of interest are derived from a univariate time series model using the ex-post real interest rates on Treasury Bills (return on Treasury Bill minus the ex-post CPI inflation rate for the period). Data indicate that for all four subperiods, integrated second order autoregressive models ARI(2,1) provide good fits.[7]

Without having to specify the exogeneous and endogeneous variables, table 7 shows that the crosscorrelations of the real interest rate, expected real interest rate, and the unexpected real interest rate with the growth rate of real economic activity. The crosscorrelations between real interest rates and real economic activity are strongly negative during 1947-1952. The crosscorrelations of the expected real interest rate and real activity during 1947-1952 are mixed, but nevertheless not signifantly positive. The crosscorrelations for both actual and expected real interest rate turn positive for the subperiods 1953-1959 and 1960-1976, and once again negative for the subperiod 1977-1983. This evidence corroborates the earlier finding that the subperiod 1947-1952 is characterized by dominant monetary shocks which predict negative correlations between the real interest rates and real activity. This finding is also consistent with positive relations between inflation and stock returns, as well as between inflation and real activity, since the relation between inflation and real interest rates are negative throughout the period of analysis.

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[7] Comparison of the ARI(2,1) models to IMA(1,1) models which have been used in some previous studies indicates that the ARI(2,1) models provides better fits as measured by lower residual autocorrelations.

Table 7

Crosscorrelations of the quarterly real rate of interest, RR, the unexpected real interest rate URR, and the ex-ante expected real rate of interest, ERR, with the annual growth rate of real activity updated each quarter, GRA. The time period of analysis is from January 1947 to June 1983.

	GRA_t				
Variable j=	-2	-1	0	1	2
Time period: January 1947 to December 1952.					
RR_{t+j}	-0.10	-0.50	-0.65	-0.57	-0.43
URR_{t+j}	-0.57	-0.67	-0.49	-0.19	0.11
ERR_{t+j}	0.55	0.17	-0.24	-0.48	-0.66
Time period: January 1953 to December 1959.					
RR_{t+j}	0.29	0.34	0.21	0.02	-0.03
URR_{t+j}	0.20	0.08	-0.13	-0.18	-0.18
ERR_{t+j}	0.08	0.23	0.42	0.36	0.27
Time period: January 1960 to December 1976.					
RR_{t+j}	0.37	0.26	0.23	0.14	0.10
URR_{t+j}	-0.01	-0.13	-0.12	-0.17	-0.14
ERR_{t+j}	0.47	0.49	0.41	0.34	0.26
Time period: January 1977 to June 1983					
RR_{t+j}	-0.47	-0.50	-0.65	-0.58	-0.49
URR_{t+j}	-0.12	-0.03	-0.14	0.11	0.03
ERR_{t+j}	-0.39	-0.48	-0.58	-0.69	-0.57

IV-Conclusions and Implications

The evidence presented in this study indicates that the relation between common stock returns and unanticipated inflation is positive during 1947-1952 for both CPI and PPI series, negative during 1953-1976 for both the CPI and PPI measures, and insignificant during 1977-1983 period for the PPI measure and marginally negative for the CPI measure. The relations between inflation and common stock returns also show up as relations of the same sign between inflation and real economic activity for each of the subperiods 1947-1952, 1953-1959, 1960-1976, and 1977-1983. A positive relation between inflation and real economic activity for the 1947-1952 subperiod indicates that there are different factors that can produce positive, negative, or an insignificant relation between inflation and common stock returns as well as between inflation and real activity.

A reconciliation of the pre-1953 results with the post-1953 results suggests that the monetary shocks as well as shocks to real activity can affect the relation between inflation and real activity. As hypothesized by Friedman (1968) and others, a dominant exogeneous monetary shock would be accompanied by a temporary movement in the same direction in output, thereby producing a positive relation between inflation and real activity as in pre-1953 period. Alternatively, a dominant exogeneous negative shock to the real activity can produce inflation. Anticipated by the market, stock prices would decline, thereby producing a negative relation between inflation and real activity as well as between inflation and common stock returns. This combined view suggests that significant shocks introduced by the government through monetary and fiscal policies can have significant effects on the real economic activity.

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