

STOCK PRICES, 1900-1995: THE REAL AND NOMINAL STORY

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ABSTRACT

Prompted by the inflation-adjusted Dow Jones Industrials Average setting its first record high in almost thirty years in 1995, this paper studies the impact of inflation on nominal and real stock prices from a theoretical, historical, and empirical perspective. While stocks are an excellent long-term hedge against inflation, nominal stock prices stagnate and real stock prices fall during a period of rapid inflation. Both nominal and real stock prices then go through a catch-up phase during the subsequent disinflation period. The history for this century is consistent with this pattern. Regression analysis between real and nominal stock prices as the dependent variables and inflation as the independent variable shows statistically significant evidence that (a) nominal stock returns are positively related to inflation while real stock returns are not; and (b) both nominal and real stock returns are negatively related to accelerations of inflation and positively related to decelerations.

Introduction

In the 1990s, as the stock market set one record after another and the Dow Jones Industrials Average (hereafter, simply “the Dow”) vaulted past one 1000 marker after another, all attention and sometimes concern was focused on the dizzying new heights the market was reaching. Stock prices were climbing to what many people considered unsustainable heights. Most conspicuously, Federal Reserve Board Chairman, Alan Greenspan, worried out loud that the market was being fueled by “irrational exuberance” as opposed, presumably, to well-grounded fundamentals. Blinded by the meteoric rise in stock prices, few noticed the Dow passing an important landmark. Late in 1995, when the Dow quietly entered the neighborhood of 4800, the stock market reached a far more significant milestone than any of the artificial “barriers” that garnered the public’s attention. Stock market prices, as measured by the Dow, had finally surpassed *in real terms* their all-time high reached in January 1966, when the Dow reached the 1000 neighborhood for the first time.¹ In spite of the many records and the more than quadrupling of average *nominal* stock prices since the 1960s, it had taken thirty years for the inflation-adjusted Dow to reclaim 1000 and set new *real* price record. Back in 1966, real stock prices began a sixteen-year downward slide. The great bull market, which started in 1982 and has since reached what seems to be such remarkable heights, took over thirteen years simply to counteract this slide and to bring the market back to its 1966 level in real terms.

Inflation has puzzling effects on stock prices. A number of studies [e.g., Fama and Schwert (1977), Fama (1981), Solnik (1983), Wilson and Jones (1987), Kaul (1987), Cochran and DeFina (1993), and Caporale and Jung (1997)] have investigated the effect of inflation—expected and unexpected—on nominal and real stock returns.² A common finding is a negative relationship between real stock returns and inflation. These results are at least partially counter-intuitive. If, as is commonly believed, stocks are an inflation hedge, a rise in the general price level should be reflected in a proportional rise in nominal stock prices with no effect on real stock prices. Historically, however, nominal stock prices have tended to level off during periods of rapid inflation (leading to declines in real stock prices) and have engaged in a catch-up process after the inflation has been reduced. The purpose of this paper is to study, historically and empirically, the impact of inflation—as well as accelerations and decelerations of inflation—on nominal and real stock prices. The effect that inflation has on the stock market, both while the inflation is occurring and after it has stopped, helps explain the market's performance over the last three decades. Furthermore, the patterns that one discovers should provide potentially very useful insight into the future movements of stock prices should the economy experience an acceleration of inflation.

The Theoretical Relationship between Inflation and Stock Prices

The Quantity Theory of Money holds that if the money supply doubles over a period that is long enough for output to increase, the excess of money supply growth over output will translate into proportionately higher prices.³ Mainly nominal values rise. Some real values do change as well, driven by their own real determinants. But no real values should change as a result (direct or indirect) of a monetary inflation. Should nominal stock prices rise in proportion to the other prices? The answer is yes, theoretically. Nominal stock prices should keep pace with the movement in the general price level, and real stock prices should be unaffected by the inflation. Is that what happens? The answer is No in the short run and Yes in the long run. Let us consider why stock prices should keep up with general inflation.

If one supposes a general economy-wide doubling of prices, a corporation's revenues and out-of-pocket costs should double. In the simplest method of calculating profits, the results would be a doubling of nominal profits and no change in real profits. With a doubling of a corporation's nominal profits should come a doubling of its stock's value and market price, presuming that the value of the stock is based upon a present value calculation of the corporation's projected nominal earnings. Those earnings could be allocated in one of two ways. They could be paid out in an increase in nominal dividends, which would drive up the stock's market value. Or they could be retained to add to the corporation's productive assets, thereby increasing the nominal book value of the corporation. That too should lead to an increased nominal market value for the stock. Either way (or in a combination of those ways), nominal stock values would rise by the same proportion as the general price level and leave real stock values unchanged.

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But stock prices will not necessarily rise while the inflation is actually occurring. There is a very good reason to expect that nominal stock prices will remain unchanged while the inflation is occurring and will rise only after the inflation episode comes to an end. That is because of the combined impacts of inflation and expected inflation on nominal interest rates and the effect of interest rates on the present value of earnings. The best way to explain this pattern is to demonstrate it with a numerical example. Suppose inflation in a particular year jumps from zero to 100% and nominal earnings double as predicted from a hypothetical \$100 to \$200. Further suppose that the pre-inflation desired real rate of interest is 10%, and the inflation is totally unexpected and, thereby, not reflected in a rise in nominal interest rates. The present value of one year's earnings would double (from \$90.90 to \$181.81) and so would the current market value of the stock.⁴ Stock prices should, therefore, double in the very near future.

However, if the inflation is fully expected, we must allow for the Fisher Effect on nominal interest rates [see Fisher (1930)]. The nominal rate would be equal to 120%.⁵ The present value of one year's earnings of \$200 is \$90.90 ($\$200 / 2.20 = \90.90), the same as if there were no inflation occurring. Thus, while the inflation is occurring (and is reflected, through inflationary expectations, in current interest rates), the market value of the corporation's stock is unchanged. Therefore, nominal stock prices should not rise, guaranteeing that real stock prices will fall. Furthermore, as long as the inflation continues and is accurately expected to continue, nominal stock prices will remain unchanged (all else equal), and real stock prices will continue to fall.

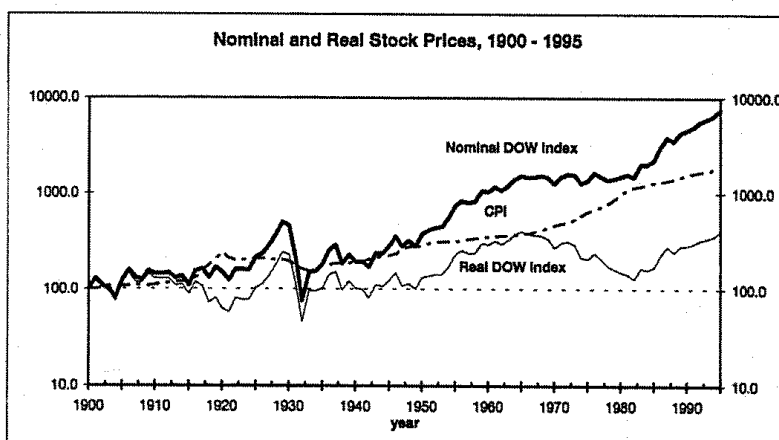
All will change, however, when the inflation stops. If the inflation episode in our experiment stops after one year and the rate of inflation returns to zero, all prices in the product and factor markets will remain permanently doubled. Nominal earnings will also still be double what they were before the 100% price surge. But the end of the inflation should bring with it the end of inflationary expectations. As a result, the nominal rate of return should drop from 120% to 10%. When we recalculate the present value of the \$200 in earnings using the 10% interest rate, the present value of the earnings doubles to \$181.81 as it did in our earlier example. Now stock prices will be free to double and reflect the doubling of the general price level. This example tells us that, as long as the inflation breeds inflationary expectations, the positive impact of inflation on stock prices should be delayed until after the inflation episode has ended. When the inflation rate comes down, inflationary expectations should decline; rates of return will fall; and stock prices will go up as they pass through a catch-up phase.

The Historical Record

It is quite common to hear stocks described as the best investment choice for a hedge against inflation — at least over the long run [for example, see Ibbotson Associates, *Stocks, Bonds, Bills, and Inflation: 1996 Yearbook*]. That has certainly been the case during this century, as the data for the 1900 - 1995 period demonstrate.⁶ Figure 1 shows that stock prices alone — i.e., not counting reinvested dividend earnings —

more than kept pace with inflation allowing real stock prices to quadruple from 1900 to 1995. Much has also been made of the rapid rise of stock prices over the more recent 1982-95 period when stock prices multiplied by a factor of 5.5 [see for example, Carlson and Sargent (1997)]. Viewed by itself, that thirteen-year period was an exceptional one, as the rise in stock prices far outpaced the 60% inflation. As a result, real stock prices more than tripled. This tripling would seem to suggest that three-fourths of the appreciation in real stock prices, which has occurred in the first ninety-five years of the century, took place in the brief period of 1982-95. Actually, it really means one of two things could have happened: (1) very little appreciation in real stock prices occurred during the preceding eighty-two years, or (2) real stock prices experienced some significant losses prior to 1982 that had wiped away substantial earlier gains making the 1982-95 surge a catch-up period. A second look at Figure 1 tells us the latter is the case.

FIGURE 1



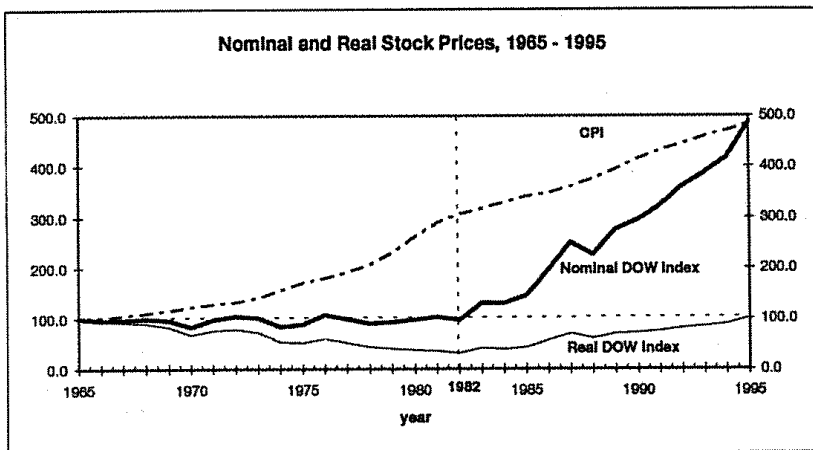
Index	Total Change in Index		Average Annual change	Compound Rate of Change
	1900	1995		
Nominal Dow	100	7473	7.1%	4.6%
CPI	100	1823	4.0%	3.1%
Real Dow	100	410	3.2%	1.5%

All appreciation in the real Dow in this century up to mid-1995 took place prior to 1966, when the nominal Dow first visited the 1000 level. By that time, the real Dow had quadrupled since 1900. What followed was a seventeen-year slide to a pre-1950 level, which put the real Dow a mere 27% above its 1900 level in 1982. The great bull market that ensued (with a couple of significant corrections) for the next thirteen years simply managed to bring the real Dow back to its 1966 level by 1995. The thirty-year period from 1966 onward showed no net gain in the real Dow even though the nominal Dow had multiplied by a factor of 4.8. That is because the general price level had multiplied by the same factor. Consequently, the effect of inflation on stock prices during the 1965-95 period is quite telling and deserves closer scrutiny.

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Beginning in the mid-1960s, the United States experienced its worst extended period of rapid inflation in history. From 1965 (when the acceleration in inflation was beginning) through 1981, the general price level tripled, and the annual inflation rate spent four years in the double-digit range. CPI inflation for the 1978-81 period alone was 40%. Starting in 1982, the inflation rate came down dramatically and averaged 3.75% for the next fourteen years. Thus, this thirty-year period can be divided into two strikingly different intervals. The first was characterized by an acceleration trend in the inflation rate with widening variations as well as generally rising nominal interest rates. This seventeen-year phase ended abruptly in 1982, and was followed by thirteen years of decelerating and steadying inflation rates. As noted earlier, coincidentally the performance of stock prices experienced two decidedly different phases — as is depicted in **Figure 2**. During the first, the 1965-82 period, stock prices went through five distinct peak-and-valley cycles. The Dow episodically reached the 1000 peak in 1966, 1968, 1973, 1976, and 1981, only to sink each time back into a valley, the lowest one at 577 in 1974. The final valley came in the summer of 1982 with the Dow near 790.

FIGURE 2



For seventeen years, the nominal Dow had drifted horizontally. A purchase of \$1,000 worth of stock in 1966 could have been sold for the same \$1,000 as late as the latter part of 1982. Unfortunately, from the peak in 1966 to the valley in 1982, the real value of that \$1,000 investment would have shrunk to \$270. This 73% “silent crash” in real stock prices has been outdone only once this century: the very steep drop from 1929 to 1933, when real stock prices fell 86%. But that more-famous plummet was far more obvious and understandable — since the economy was in the midst of its worst contraction, and nominal stock prices themselves fell almost 90%. The 1966-82 decline in real stock prices came during a far lengthier period during which output was generally climbing and nominal stock prices were essentially level. From early 1966, when the Dow reached 1,000 for the first time, to the end of 1982, when the Dow regained 1,000 for the fifth time, the entire drop in the real Dow was due to the impact of inflation.

The second phase was marked by an extraordinary ascent of nominal stock prices as the nominal Dow exceeded one millenary milestone after another and surpassed 5,000 by the end of 1995. But as the nominal Dow was reaching its heights, the real Dow was simply making up ground it had lost during the preceding phase. After bottoming out in 1982, the real Dow strove for thirteen years to regain its 1966 level. In 1995, with the nominal Dow passing 4,800, a \$1,000 investment made in 1966 would finally once again have sold for an inflation-adjusted \$1,000. As Figure 2 helps us see, had the nominal Dow simply kept up with inflation (as depicted by the CPI line) from 1965 onward, the nominal Dow would have passed 3,000 in 1982 instead of languishing below 1,000. In fact, it was not until 1995 that the nominal Dow actually did catch up to the CPI and the real Dow topped its 1966 level. Furthermore, had the real Dow continued its 1900-65 long-term trend of 2.2% annual growth, it would have reached 1,921 by 1995. Add on the inflation adjustment of 4.8 (for the 1965-95 period) mentioned earlier, and one can argue that the Dow should have surpassed 9,000 in 1995, four years earlier than it actually did.

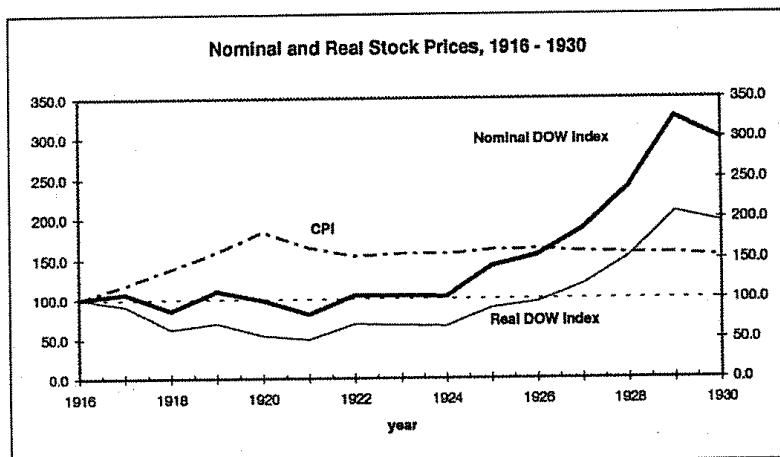
These results contradict the many doomsayers who suggest stocks are overvalued as the stock market has reached such lofty levels. When viewed from this perspective, the lengthy and rapid ascent of stock prices during the 1982-95 period and since has been perfectly understandable and predictable, not to mention long overdue. Indeed, some market prophets predicted exactly such a long-term market adjustment before it started.⁷ During the 1965-82 period, the book value of the stocks included in the Dow or most any other index continued to rise, while stock prices went flat. That was a seeming paradox, and signaled a future upward adjustment, which finally came in the 1980s.

The pattern we see during the 1965-95 period has been observed at least once before, during the 1916-30 period. An inflation acceleration, which was caused by money supply increases associated with Treasury financing of the war, began in 1916. It produced a doubling of the general price level by 1920.⁸ Prices fell back by one third of that run-up in the next two years and were essentially level to the end of the decade. Thus, we have a four-year inflation surge followed by a ten-year period of combined deflation and price stability. Stock prices followed a path that was similar to the 1965-95 period, as Figure 3 shows. During the inflation period, the nominal Dow showed virtually no net change, but the real Dow fell by almost 50%. It took six years thereafter for the real Dow to reattain its 1916 level. During that time, the nominal Dow doubled. Thus, until after 1926, the great bull market of the 1920s was simply an unremarkable and predictable inflation catch-up phenomenon. It was only after 1927 that the real Dow moved into territory it had not already visited before the World War I years. The real Dow then proceeded remarkably to double in just three years.

These two periods tell a common story that is consistent with the theoretical scenario outlined in the preceding section. That is, in the long run, the stock market does reflect inflation in the *ex-post* level of nominal stock prices. But the rise of nominal stock prices does not necessarily happen while the inflation itself is occurring. Instead,

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FIGURE 3



the market performs quite poorly in real terms during the inflationary phase. And even though nominal stock prices may show little net change, during this phase, real stock prices fall steeply. Thus, while the inflation is proceeding, there is no relationship between the rise in general prices and the level of nominal stock prices, since the latter tends to change very little. On the other hand, a negative relationship between the inflation rate and real stock prices appears to exist. An entirely different pattern arises during the subsequent disinflation phase. The slowdown in the inflation rate is greeted by an upward surge in both nominal and real stock prices — hence again the apparent negative relationship between the inflation rate and real stock prices. The end result of this catch-up stock rally is a recovery of real stock prices to their pre-inflationary-period level and a rise in nominal stock prices that is in proportion to the total rise in the general price level over both phases of the process.

These patterns are at least partially borne out by the data provided in **Table 1** on average annual rates of return on the nominal and real Dows grouped by rates of inflation or deflation. Both indexes of stock prices perform well during periods of little or no inflation and progressively worse as the inflation rate moves into categories of moderate (2.8% to 4%) and rapid (more than 4%) inflationary regimes. These patterns are consistent with the notion that, while nominal stock prices are pushed upward by inflation, they do most of their rising during a catch-up phase after the inflation rate has settled back down. It is worth noting that this two-staged pattern can lead to a significant redistribution of wealth if those who buy stocks during the inflation phase are significantly different from those who buy during the disinflation phase. Those buying during the first phase experience real losses, and those buying during the second phase reap major gains, possibly at the expense of the former group. If the two phases taken together occur within a relatively short time period — as they did in the 1916-26 period — many of the gainers of phase two will simply be the same people who bought and held through both phases. This results in no redistribution. However, given the extended length of the time between when the nominal Dow reached

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the 1,000 zone in 1966 and the beginning of the rally in 1982, the gainers of the 1980s were in many cases of a different group, even a different generation, from the losers of the 1970s. As is usually the case, the long-run impact of inflation is primarily distributional.

Regression Evidence

There are two types of change in the Dow that are of interest in this study—that is, the changes in the nominal Dow and changes in the real Dow, which is the nominal Dow series deflated by the inflation rate. The patterns we just examined suggest a group of relationships that should be open to confirmation through empirical tests. Those relationships are the following:

TABLE 1
AVERAGE INFLATION AND AVERAGE RETURNS ON THE DOW

<u>Inflation Rate</u>	<u>No. of Years</u>	<u>Aver. Rate</u>	<u>Average Return Nominal Dow</u>	<u>Average Return Real Dow</u>
less than 0%	10	-5.1%	5.1%	9.9%
0% to 2.79%	37	1.2%	10.8%	9.5%
2.8% to 4%	17	3.4%	7.3%	3.7%
more than 4%	31	8.1%	3.2%	-4.5%
total	95	4.0%	4.6%	1.5%

a. In the long run, nominal stock prices are pushed upward by increases in the general price level, and we would expect a positive relationship between the rate of inflation and the rate of change of the nominal Dow.

b. Even though real stock prices are apparently buffeted about by changes in the inflation rate in the short run, we would not expect a relationship to exist between inflation and a real variable such as the real Dow. Real stock prices should not be determined by nominal values.

c. Since the major moves in real and nominal stock prices appear to have been associated with significant changes in the inflation rate, we would expect strong relationships between accelerations and decelerations of the inflation rate and the movements of both the real and nominal Dow.

In order to confirm these relationships, separate regressions were run between the rate of change in the nominal Dow and the real Dow as dependent variables and a group of independent variables including the actual inflation rate and accelerations and decelerations in the inflation rate.

The Data: Data were gathered for the 1900-1995 period. The level of the Dow Jones Industrial Average was collected for the 1900-1954 period from *The Dow Jones Average 1885-1985* and the *Economic Report of the President* for 1955-1995 period. Consumer Price Index (CPI) data were collected for the century from *Historical Statistics of the United States Colonial Times to 1970* and *The Economic Report of the President*. The nominal levels of the Dow were then adjusted by the CPI to create real Dow levels. Annual inflation rates and annual rates of change in both the nominal Dow and real Dow were computed as percentage changes in the respective annual levels.

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The inflation rate during any period can be defined to consist of two parts—the expected rate and the unexpected rate:

$$\text{INFL}_t = \text{INFL}_t^e + \text{INFL}_t^u \quad (1)$$

where INFL_t^e is the expected component of inflation and INFL_t^u is the unexpected component in the inflation rate during period t . We will define the expected inflation rate in any year as simply the actual inflation rate during the preceding year — that is, $\text{INFL}_t^e = \text{INFL}_{t-1}$. And the unexpected component is defined as the difference between this year's and last year's inflation rates—that is, $\text{INFL}_t - \text{INFL}_{t-1}$. Substituting into equation (1):

$$\begin{aligned} \text{INFL}_t &= \text{INFL}_{t-1} + \text{INFL}_t^u; \text{ or} \\ \text{INFL}_t^u &= \text{INFL}_t - \text{INFL}_{t-1} \end{aligned} \quad (2)$$

When INFL_t^u is positive, the INFL_t is greater than the previous year's inflation INFL_{t-1} . In this case, the inflation is said to be *accelerating*. Conversely, when INFL_t^u is negative, inflation is said to be *decelerating*.

The Regression: In order to measure the impacts of inflation and the accelerations and decelerations in the inflation rate on the Dow returns, the following regression specifications were used:

$$\% \Delta \text{DOW}_t = \alpha + \beta_1 (\% \Delta \text{DOW}_{t-1}) + \beta_2 (\text{INFL}_t) + \beta_3 (\text{INFL}_t^u) + \beta_4 (\text{DUM} * \text{INFL}_t^u) \quad (3)$$

The change in the Dow in the previous period, $(\% \Delta \text{DOW}_{t-1})$, is included since it is likely that, in addition to inflation, there are other forces at work in generating the return series. Also, the inclusion of $(\% \Delta \text{DOW}_{t-1})$ controls for the effect of first order auto-correlation in the return series. The impact of the rate of inflation on the return series is captured by the inclusion of (INFL_t) , and (INFL_t^u) measures the impact of unanticipated inflation—that is, accelerations and decelerations.

The hypotheses suggest that both the direction and the magnitude of the unanticipated inflation have an impact on the Dow series. In order to capture the potentially differential impacts of acceleration versus deceleration in the inflation series, we employ a dummy variable (DUM) which takes on a value of 1 if the INFL_t^u is positive (accelerating inflation), otherwise DUM takes on a value of zero (decelerating inflation). When there is deceleration in inflation ($\text{DUM} = 0$), the equation collapses to:

$$\% \Delta \text{DOW}_t = \alpha + \beta_1 (\% \Delta \text{DOW}_{t-1}) + \beta_2 (\text{INFL}_t) + \beta_3 (\text{INFL}_t^u) \quad (3a)$$

Consequently, the impact of decelerating inflation is captured by the coefficient β_3 . When there is acceleration in the level of inflation, the dummy variable, DUM, equals 1, and the regression equation becomes:

$$\% \Delta \text{DOW}_t = \alpha + \beta_1 (\% \Delta \text{DOW}_{t-1}) + \beta_2 (\text{INFL}_t) + \beta_3 (\text{INFL}_t^u) + \beta_4 (\text{INFL}_t^u); \text{ or}$$

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$$\% \Delta DOW_t = \alpha + \beta_1 (\% \Delta DOW_{t-1}) + \beta_2 (INFL_t) + (\beta_3 + \beta_4) * (INFL_t^u) \quad (3b)$$

The impact of accelerating inflation is measured by $(\beta_3 + \beta_4)$.

Similar to the specification based on changes on the nominal Dow, we have another specification based on changes in the level of real Dow.

$$\% \Delta RealDOW_t = \alpha + \beta_1 (\% \Delta Real DOW_{t-1}) + \beta_2 (INFL_t) + \beta_3 (INFL_t^u) + \beta_4 (DUM * INFL_t^u) \quad (4)$$

The significance levels of the coefficients α , β_1 , β_2 , β_3 , and β_4 in both equations are given by the corresponding t-statistics, and the significance of $(\beta_3 + \beta_4)$ is given by an F-statistic.

The Results: The regression results are presented in Table 2. In each panel, the coefficient estimates are reported. Below the coefficients, the corresponding t-statistics are presented in parentheses. And in the square brackets below, the significance level of the t-statistics are shown. The impact of accelerating inflation is shown as $(\beta_3 + \beta_4)$ and $(\Theta_3 + \Theta_4)$. Corresponding F-statistics are shown in square brackets below.

In the first panel, the regression results corresponding to the nominal Dow returns are shown. The intercept is positive and very highly significant at better than a 1% level. The coefficient β_1 , corresponding to $\% \Delta Nominal DOW_{t-1}$, is negative but not

TABLE 2
OLS REGRESSION OF CHANGES IN DOW JONES AGAINST INFLATION

Panel A							
	Intercept	Regression with % Change in the nominal DOW as the dependent variable				F-stat	Adj R ²
		% Change in Nominal DOW _{t-1}	Actual Inflation _t	Decelerating Inflation _t	Accelerating Inflation _t		
% Change in Nominal DOW _t	α	β_1	β_2	β_3	β_4		
	0.101	-0.1221	1.7342	1.5421	-3.3562	6.42	18.9%
	(3.91)***	(-1.26)	(2.64)***	(2.69)***	(-4.38)***	***	
	[0.0%]	[21.3%]	[0.1%]	[0.8%]	[0.0%]	[0.0%]	
Coefficient of $\beta_3 + \beta_4 = -1.81$; F-statistic of 4.11, significant at 4.5% level.							
Panel B							
	Intercept	Regression with % Change in the real DOW as the dependent variable				F-stat	Adj R ²
		% Change in Real DOW _{t-1}	Actual Inflation _t	Decelerating Inflation _t	Accelerating Inflation _t		
% Change in Real DOW _t	γ	θ_1	θ_2	θ_3	θ_4		
	0.0987	-0.1313	0.7131	1.7224	-3.3424	7.55	22.0%
	(3.79)***	(-1.35)	(1.06)	(2.86)***	(-4.32)***	***	
	[0.0%]	[18.0%]	[29.1%]	[0.5%]	[0.0%]	[0.0%]	
Coefficient of $\theta_3 + \theta_4 = -1.62$; F-statistic of 3.07, significant at 8.3% level.							
Variables Defined							
% Change in Nominal DOW _t	Change in nominal Dow, is computed as: $\{(Dow/Dow_{t-1})-1\}$.						
% Change in Real DOW _t	Computed as: $\{(Real Dow/Real Dow_{t-1})-1\}$. Real Dow is Dow deflated by the inflation for the period.						
Actual Inflation _t	Computed as the % change in the level of CPI _t from CPI _{t-1} : $\{(CPI_t/CPI_{t-1})-1\}$.						
Accelerating Inflation _t	The difference between Actual Inflation, and Actual Inflation _{t-1} if it is positive. $Infl_t - Infl_{t-1}$ if it is > 0.						
Decelerating Inflation _t	The difference between Actual Inflation, and Actual Inflation _{t-1} if it is negative. $Infl_t - Infl_{t-1}$ if it is < 0.						

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statistically significant. There is, at best, a very weak level of negative first-order correlation in the nominal return series. It is the next coefficient, which captures the impact of inflation on the nominal Dow that is of particular interest. β_2 is positive and very highly significant (at a 1% level). This is strong corroborating evidence that, after controlling for other effects, a positive correlation exists between inflation and the movement of nominal stock returns.

The coefficient β_3 is positive and statistically very highly significant (0.8% level). When there are decelerations in inflation, the nominal returns are positively impacted. The bigger the deceleration, the bigger is the increase in the nominal Dow. When there is an acceleration in the rate of inflation, the coefficient measure ($\beta_3 + \beta_4$) is -1.814 and is statistically significant at the 4.5% level. This suggests that nominal returns on the Dow are negatively impacted when there is an acceleration in the inflation rate. The greater is the acceleration of inflation, the greater is the drop in the nominal Dow.

In the panel B of Table 2, the returns on the real Dow are examined. As in the previous panel, the intercept term is positive and very highly significant, and the first order auto-correlation term Θ_1 is negative but not statistically significant. The coefficient Θ_2 , corresponding to contemporaneous inflation, $INFL_t$, is positive but not statistically significant. It appears, as we theorized, that the changes in real Dow are not affected by the prevailing level of inflation. The coefficient Θ_3 is positive and highly significant. As in the case of the nominal returns, we find a positive and highly significant (at the 0.5% level) impact of decelerations of inflation on real returns—that is, the bigger the deceleration of inflation, the bigger the increase in the real Dow returns. Similarly, the impact of accelerating inflation on the real Dow is also negative—that is, ($\Theta_3 + \Theta_4$) is -1.62—and highly significant at the 8.3% level.

These results are consistent with the pattern we observed earlier. Namely, the real Dow suffers during periods of accelerating inflation and recovers during the subsequent period of disinflation. Otherwise long run movements in the real Dow are not significantly influenced by the rate of inflation. The real rate of return is not a constant over time, but on the other hand it is not influenced by inflation.

It may be noted that in regression runs without the acceleration/deceleration variables included show a significant negative relationship between the inflation rate and real returns on stocks. The results, not reported here, are consistent with the negative relationship between inflation and real stock returns found in other studies mentioned earlier. However, when the acceleration/deceleration variables were added to the equation, the negative relationship became statistically insignificant. It would appear that it is the direction and size of the *change* in the inflation rate that matters more to real returns on stocks than the actual level of the inflation rate.

All of the relationships that we outlined at the beginning of this section have been supported by the regression results:

a. Movements in nominal stock prices are positively correlated with movements in the general price level.

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b. Movements in real stock prices are not correlated with movements in the general price level.

c. Movements in both real and nominal stock prices are related to accelerations and decelerations in the inflation rate—that is, negatively correlated with accelerations in the inflation rate and positively correlated with decelerations in the inflation rate.

Conclusion

Stock market watchers are well aware of the impact of inflation fears on the market. An increase in the fear of inflation typically sends stock prices falling. Knowledge of the positive impact of inflationary expectations on nominal interest rates and the inverse relationship between interest rates and stock prices provides one explanation for the market reaction. What does not seem so apparent to market watchers are the following: a. the difference between the movements of real and nominal stock prices—particularly during periods of rapid inflation, b. the long-run impact of inflation on nominal stock prices, and c. the short-run effect of accelerations and decelerations of inflation on both nominal and real stock prices.

An awareness of those latter relationships comes only with an historical perspective and empirical corroboration. The evidence of this century shows us that over the long run nominal stock prices will more than keep up with the rate of inflation. But during periods of rapid and accelerating inflation, nominal stock prices will stagnate, and real stock prices will fall. Then, once the inflation rate is reduced, nominal stock prices will climb until real stock prices catch up to and pass the level they attained before the inflation episode. This catch-up phase can be one of dramatic increases in nominal stock prices. The net result is a long-term positive trend in real stock prices that is consistent with the rising real net asset value of corporations and a long-run positive trend in nominal stock prices that includes the combined effects of the real stock price trend and inflation.

Were one to look simply at the period from 1982 onward, one could conclude that stock prices have been rising at a rate that was hard to justify. However, that would be a misinterpretation of the longer-term picture. When the market record is viewed from the 1960s forward, we see that until the nominal Dow reached 4,800 in 1995, real stock prices were still below levels achieved thirty years earlier. Since then, stock prices have somewhat more than doubled in real terms. That is impressive, but neither alarming nor surprising.

Notes

1. Throughout this discussion, the Dow Jones industrial average is used as the measure of stock prices primarily because of its easily-identifiable landmarks, such as 1000, which simplify the presentation of historical data—particularly real stock prices.

2. The emphasis in several of these studies has been on the impact of changes in monetary policy on the relationships between inflation and real stock prices.

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3. See Fisher (1911).

4. The calculation is:

$$\$100 / 1.10 = \$90.90 \text{ to } \$200 / 1.10 = \$181.81$$

5. The calculation is:

$$\begin{aligned} \text{Nom rate} &= \text{real rate} + \text{exp. infl. rate} + (\text{real rate} \times \text{exp inf. rate}) \\ 120\% &= 10\% + 100\% + .10 \times 100\% \end{aligned}$$

6. All figures, tables, and descriptions of the Dow derive from the following data and calculations. The level of the Dow Jones Industrial Average was collected for the 1900 - 1954 period from The Dow Jones Average 1885 - 1985 and the *Economic Report of the President* for 1955 -1995 period. Consumer Price Index (CPI) data were collected for the century from *Historical Statistics of the United States Colonial Times to 1970* and *The Economic Report of the President*. The nominal levels of the Dow were then adjusted by the CPI to create real Dow levels. Annual inflation rates and annual rates of change in both the nominal Dow and real Dow were computed as percentage changes in the respective annual levels.

7. See Blamer and Schulman (1982), as an example.

8. See Friedman and Schwartz (1967).

References

- Bodie, Z. "Common Stocks as a Hedge against Inflation." *Journal of Finance* 31 (1976): 459-70.
- Blamer, T. and Schulman, R. *Dow 3000*. New York: Wyndham Books, 1982.
- Caporale, Tony and Jung, Chulho. "Inflation and Real Stock Prices." *Applied Financial Economics* 7, no. 3 (June 1997): 265-66.
- Carlson, John B. and Sargent, Kevin H. "The Recent Ascent of Stock Prices: Can It Be Explained by Earnings Growth or other Fundamentals." *Economic Review of the Federal Reserve Bank of Cleveland* 33 (Second quarter 1997): 2-12.
- Cochran, Steven J. and DeFina, Robert H. "Inflation's Negative Effects on Real Stock Prices: New Evidence and a Test of the Proxy Effect Hypothesis." *Applied Economics* 25, no. 2 (February 1993): 263-74.
- Fama, Eugene F. "Stock Returns, Real Activity, Inflation, and Money." *American Economic Review* 71, (September 1981): 545-65.
- Fama, Eugene F. and Schwert, G. William. "Asset Returns and Inflation." *Journal of Financial Economics* 5 (1977): 115-46.
- Feldstein, Martin. "Inflation and the Stock Market." *American Economic Review* 70 (1980): 837-47.
- Fisher, Irving. *The Rate of Interest*. New York: MacMillan, 1930.
- Fisher, Irving. *Purchasing Power of Money*. New York: A.M. Kelley, 1963 [1911].
- Friedman, Milton and Schwartz, Anna J. *A Monetary History of the United States, 1867-1960*. Princeton, N.J.: Princeton University press, 1963.
- Ibbotson Associates. *Stocks, Bonds, Bills, and Inflation: 1996 Yearbook*. Chicago: Capital Market Research Center, 1996.
- Kaul, Gautam. "Stock Returns and Inflation: The Role of the Monetary Sector." *Journal of Financial Economics* 18, (1987): 253-76.
- Nelson, Charles R. "Inflation and Rates of Return on Common Stocks." *Journal of Finance* 31 (1976): 471-83.
- Schwert, G. William. "The Adjustment of Stock Prices to Information about Inflation." *Journal of Finance* 36 (1981): 15-29.
- Solnik, Bruno. "The Relation Between Stock Prices and Inflationary Expectations," *Journal of Finance* 38 (March 1983): 35-48.
- Stulz, Rene M. "Asset Pricing and Expected Inflation." *Journal of Finance* 41 (1986): 209-23.
- Wilson, Jack W. and Jones, Charles P. "A Comparison of Annual Common Stock Returns: 1871-1925 with 1926-85." *Journal of Business* 60, no.2, (1987): 239-58.
- Wilson, Jack W. and Jones, Charles P. "Common Stock Prices and Inflation: 1857-1985." *Financial Analysts Journal*. (July-August 1987): 67-71.

