Equity Valuation and Inflation: A Review

Stephen E. Wilcox, CFA
Minnesota State University, Mankato

In theory, equity returns should be neutral to inflation. In practice, however, evidence of such behavior in the short run has been difficult to come by. This literature review provides a synopsis of much of the academic and practitioner research regarding the effects of inflation on equity prices.

Jeremy Siegel (2008), the author of *Stocks for the Long Run*, points out that the real return on U.S. equities has been remarkably consistent over time. Although rising prices could crimp profits in the short term, Siegel argues that companies can eventually pass on higher costs to consumers. Thus, stock market returns are neutral to inflation over the very long term. Jaffe and Mandelker (1976) provide evidence consistent with Siegel's for the time period of 1875 to 1970.

In contrast, John Maynard Keynes (1924) famously noted that "the long run is a misleading guide to current affairs. In the long run we are all dead." Although many assume Keynes was advocating short-term gains over long-term performance, he was actually criticizing the belief that inflation could be controlled without government intervention. But the statement could also be applied to the evidence that inflation is a wash for stock returns over the very long term: Who cares? "In the long run we are all dead."

Just how long is the very long term? Should an investor be concerned with inflation's short-run effect on equity prices? The answer to the latter question appears to be a resounding yes, because Siegel (2008) also indicates that stocks can be a poor short-term hedge for inflation. Bodie (1976) has gone so far as to comment "that to use common stocks as a hedge against inflation, one must sell them short." There is an obvious concern in the literature over the short-run effects of inflation on equity prices.

The parsing of the literature referenced in this review is easier to comprehend if one understands the conditions under which equity prices (or real equity returns) would be considered inflation neutral—that is, unaffected by inflation. In the context of the dividend discount model (DDM), stocks will be inflation neutral if three conditions are met: (1) Inflation is correctly anticipated by market participants, (2) expected inflation affects nominal required return and nominal dividend growth in a similar manner, and (3) the real required rate of return and the real dividend growth rate are unaffected by changes in expected inflation.

Equation 1 presents the well-known constant-growth DDM. P_0 is the current period stock price, D_0 is the current period dividend, r is the nominal required rate of return, and g is the nominal growth rate of both dividends and earnings:

$$P_0 = \frac{D_0(1+g)}{r-g}. \tag{1}$$

Via Equation 2, assume that a generalized Fisher equation (Fisher 1930) specifies the relationship between a nominal rate, k, the real rate, K, and expected inflation, i:

$$(1+k) = (1+K)(1+i). \tag{2}$$

Given the three assumptions regarding inflation neutrality, Equation 1 and Equation 2 can be used to produce the result that equity prices are unaffected by expected inflation; see the mathematical exposition prior to Equation 3 below. Note that price, P_0, can be determined using the nominal required return, r, the nominal growth rate, g, and Equation 1, or, equivalently, by using the real required return, R, and the real dividend and earnings growth rate, G, as noted in Equation 3. This result implies that stock prices are inflation neutral, or unaffected by expected inflation:

$$P_0 = \frac{D_0(1+g)}{r-g};$$
$$P_0 = \frac{D_0(1+G)(1+i)}{\left[(1+R)(1+i)-1\right]-\left[(1+G)(1+i)-1\right]}; \quad (3)$$
$$P_0 = \frac{D_0(1+G)}{R-G}.$$

For a stock to be an imperfect hedge against inflation requires a violation of one or more of the three assumptions needed to produce the result of inflation neutrality. One of the focuses of the literature has been on the reasonable premise that inflation is often not correctly anticipated by investors, which violates the first assumption and thus makes stocks an imperfect hedge. What if unexpected inflation results in actual inflation differing significantly from what is expected? How does this impact equity prices and valuation measures?

Second, stocks are also an imperfect hedge if market participants consistently make cognitive errors and do not adjust both the nominal required return and the nominal growth rate for changes in expected inflation. According to the money-illusion hypothesis, investors make the behavioral error of discounting real cash flows using a nominal discount rate, which results in equities that are underpriced during periods of rapidly rising inflation.

Third, stocks are an imperfect hedge when changes in the real required rate of return or the real dividend and earnings growth rate are not independent of changes in inflation. Some authors argue that the risk premium on stocks increases during periods of high inflation or during periods when the volatility of changes in inflation is increasing. Others argue that high inflation rates complicate the analysis of financial statements, making it difficult to determine real growth rates from reported profits.

In the following sections, the discussion of the literature is congruent with the three noted violations of inflation neutrality. The discussion will cover (1) many of the influential studies regarding the relationship between unexpected inflation and equity prices, (2) the notable research on money illusion as it pertains to the way that this behavioral problem influences the pricing of equities, (3) the literature regarding the ways in which inflation impacts real growth rates and risk premiums, and (4) a bibliography with quoted passages from each reference that summarize important results.

Unexpected Inflation

Most of what the majority of academics consider seminal studies regarding the relationship between unexpected inflation and equity prices appeared in the mid- to late 1970s and early 1980s. Lintner (1975), Bodie (1976), Jaffe and Mandelker (1976), Nelson (1976), Fama and Schwert (1977), Schwert (1981), Fama (1981), and Geske and Roll (1983) reported a significant negative relationship between the two variables. These studies all appear to have been written in synchrony with the "stagflation" (i.e., the combination of high rates of inflation but low levels of—or low rates of growth in—real output) that prevailed in the United States during this time period. Two major equity market sell-offs also served as catalysts for this research: The S&P 500 Index declined 48.2 percent during the 1973–74 bear market and 27.1 percent during the 1980–82 bear market.

Several authors offered theoretical arguments for the negative relationship between inflation and real output and equity prices during this time period. Lintner (1975) makes the case that equity values fall in the presence of inflation as a result of an increased need for companies to raise external financing. Regardless of whether debt or equity financing is used to meet the added requirements for external funds, the company's real cost of capital will rise. This increase reduces the optimal rate of real growth, even if profit margins are maintained and product demand continues to expand at the same rate.

Fama's (1981) proxy hypothesis contends that rising inflation will reduce real economic activity and the demand for money. In turn, rational investors believe a reduction in economic activity will negatively affect future corporate earnings, which, in turn, will result in lower equity prices. Thus, the negative relationship between stock returns and contemporaneous inflation is a proxy effect in the sense that it reflects the detrimental effects inflation will have on future real economic activity. Fama argues that the proxy effect will vanish if real economic activity does not fall because of inflation.

Elaborating on Fama's work, Geske and Roll's (1983) reversed causality hypothesis proposes that besides money demand, money supply may also explain the phenomenon. This is because equity prices are also correlated with an anticipated decline in government revenues. Budget deficits will require additional U.S. Treasury borrowings, and the U.S. Federal Reserve's monetization of these borrowings will ultimately result in higher inflation. Thus, the negative relationship between stock returns and contemporaneous inflation is a reflection of how each reacts to anticipated fiscal and monetary actions.

Most of the related studies that followed these early works either provide additional reasons for the negative relationship between inflation, on the one hand, and real output or stock prices, on the other, or attempt to confirm or refute earlier claims. Stulz (1986) provides an equilibrium model in which expected real returns on common stocks are negatively related to expected inflation and money growth. Kaul (1987, 1990) hypothesizes that the relationship between stock returns and inflation varies over time in a systematic manner depending on the influence of the monetary authority. Post-war evidence from the United States, Canada, the United Kingdom, and Germany indicates that the negative stock return–inflation relationship is caused by counter-cyclical monetary policies. Furthermore, the relationship is strongest when the central bank targets interest rates rather than the money supply. Pearce and Roley (1983) find that stock prices respond only to unanticipated changes in the money supply.

James, Koreisha, and Partch (1985) use a vector-autoregressive moving average (VARMA) model to simultaneously investigate the relationships among stock returns, real activity, inflation, and money supply. Their empirical results strongly support Geske and Roll's reversed causality hypothesis. In contrast, using a vector autoregression (VAR) model, Lee's (1992) major findings are more compatible with Fama's proxy hypothesis. According to Lee, stock returns help explain real activity, but stock returns explain little about variation in inflation and inflation explains little about variation in real activity.

Ram and Spencer (1983) disagree with Fama's contention of a negative relationship between inflation and real activity because it is contrary to Phillips curve analysis, which predicts a positive relationship. Benderly and Zwick (1985) contend that the inverse relationship between inflation and output runs from current inflation to future output via a real balance effect. McQueen and Roley (1993) claim that the negative relationship between real economic activity and stock prices appears only under some specific circumstances. In particular, news of higher-than-expected real activity when the economy is already strong results in lower stock prices, whereas the same surprise in a weak economy is associated with higher stock prices.

Boudoukh and Richardson (1993) find strong evidence in favor of stocks as inflation hedges in long-horizon returns in the United States and the United Kingdom. With a one-year investment horizon, these authors also find evidence for a significantly negative relationship between nominal stock returns and inflation. Barnes, Boyd, and Smith (1999) find that inflation and nominal equity returns are negatively correlated or uncorrelated for the low-to-moderate inflation economies in their sample, but they are strongly positively correlated for high inflation economies.

Feldstein (1980) proposes a tax hypothesis to help explain the inverse relationship between higher inflation and lower share prices. He argues that an important adverse effect of increased inflation on share price is a result of the basic features of U.S. tax laws, particularly historic cost depreciation and the taxation of nominal capital gains. According to Feldstein's model, an increase in the rate of inflation raises the effective tax rate on equity earnings relative to the tax rate on other types of investment income. Gonedes (1981) finds no link between inflation and the real corporate tax burden and concludes that there is "implicit indexing" through the introduction of accelerated depreciation methods and other corporate tax breaks. McDevitt (1989) shows that the negative relationship between real returns and inflation is not altered if tax-related variables are included in the regression. In contrast, Ammer (1994) finds evidence that is supportive of corporate tax–related theories regarding the relationship between inflation and equity prices.

Several studies have examined the relationship between unexpected inflation and individual stock returns. Bernard (1986) shows that return differences are best explained by differences in systematic risk. Pearce and Roley (1988) find that companies with high debt–equity ratios are less susceptible to the adverse effects of positive, but unanticipated, inflation. Asikoglu and Ercan (1992) show the fraction of inflation that flows through to profit growth is a key determinant of the sensitivity of the stock price to changes in inflation. Using high frequency data, Adams, McQueen, and Wood (2004) find that the negative inflation–stock return relationship is stronger for large stocks when the economy is strong and there is an unexpected increase in inflation. Wei (2009) shows that equity returns of medium-sized companies with lower book-to-market ratios are more negatively correlated with unexpected inflation.

Money Illusion

Though the term "money illusion" is often attributed to the legendary economist John Maynard Keynes, this behavioral problem was first treated fully by Fisher (1928) in his book *The Money Illusion*. Fisher's formal definition was that money illusion is "the failure to perceive that the dollar, or any other unit of money, expands or shrinks in value." In application, the term is usually a reference to the nominal value of a currency being mistaken for its purchasing power or real value.

The Modigliani–Cohn Hypothesis. Any research regarding the effect of money illusion on equity markets inevitably refers to Modigliani and Cohn (1979). These authors hypothesize that stock market investors suffer from money illusion because they discount real cash flows using nominal discount rates. The term "real cash flow" refers to a contemporaneous cash flow (such as dividends or earnings) that is unaffected by inflation expectations, whereas nominal discount rates are market rates that reflect expectations regarding future inflation. The fame of this work is such that the term "Modigliani–Cohn hypothesis" is generally used to imply that investors suffer from behavioral problems that result in inflation-induced valuation errors.

The Modigliani–Cohn hypothesis predicts that the stock market will become undervalued during periods of high inflation. Because this undervaluation should be eliminated once actual nominal cash flows are revealed, high inflation today ultimately results in higher future returns. Ritter and Warr (2002) support this idea with a detailed empirical analysis of the 1983–2000 bull market.

There are many other papers that empirically document the impact of money illusion on stock market prices. Campbell and Vuolteenaho (2004) use a dynamic log-linear valuation method and a subjective proxy for the equity risk premium to show that a large part of the mispricing in the dividend-to-price ratio can be explained by money illusion. Cohen, Polk, and Vuolteenaho (2005) focus on the cross-sectional implications of money illusion for asset returns and find supportive evidence for the Modigliani–Cohn hypothesis. Chordia and Shivakumar (2005) show that lagged inflation predicts future earnings growth, abnormal returns, and earnings announcement returns of stocks sorted by standardized unexpected earnings.

Despite the high stakes in the stock market suggesting that money illusion should quickly be arbitraged away, several papers show that even a small amount of money illusion is sufficient to generate large effects. Fehr and Tyran (2001) use an experimental setting with computerized opponents to show that the combined direct and indirect effects of money illusion generate a very large increase in nominal inertia. Basak and Yan (2010) provide a belief-based formulation of money illusion that accounts for systematic mistakes in evaluating real and nominal quantities. In the psychology literature, Svedsäter, Gamble, and Garling (2007) highlight the role of money illusion in financial decision making via a number of experiments, showing that investors may be influenced by the nominal representation of stock prices when evaluating financial information.

The Fed Model. Pundits frequently argue that a leading practitioner model of equity valuation, the Fed model, falls prey to money illusion. The model compares the stock market's earnings yield, which is (approximately) real, with the yield on long-term government bonds, which is nominal. The simplest version of the model predicts that the stock market is fairly valued when the two are equal. Stocks are considered undervalued

when the earnings yield exceeds the Treasury yield and overvalued when the Treasury yield exceeds the earnings yield. The Fed model can be generalized to say that the relationship between the earnings yield and the Treasury yield is predictive of stock returns in excess of bonds, without asserting that the two asset classes are fairly valued when the two yields are equal.

The Fed model was so named by the economist Edward Yardeni based on the Federal Reserve's Humphrey–Hawkins Report, 22 July 1997, which made comparisons between the earnings yield for the S&P 500 and the yield on 10-year Treasury notes. But bond yield versus equity yield comparisons have been used in practice long before 1997. For example, I/B/E/S has been publishing the forward-earnings yield on the S&P 500 versus the 10-year Treasury since the mid-1980s.

The Fed model has drawn a slew of critics. Asness (2003) argues that the model's usage is misguided, most likely because of a confusion of real and nominal earnings (money illusion). Campbell and Vuolteenaho (2004) claim that, although the Fed model provides a behavioral description of stock prices, there is serious difficulty with the model as a rational explanation of stock prices. These authors' empirical results are consistent with the Modigliani–Cohn hypothesis, and they also find that the level of inflation explains a majority of the time-series variation in stock market mispricing. Similarly, Feinman (2005) convincingly argues that forecasts of future nominal cash flows are not always based on the same expected rate of inflation as the one that is included in the nominal interest rate used to discount those cash flows.

Some of the literature, however, is supportive of explanations other than the Modigliani–Cohn hypothesis for the strong observed relationship between the earnings yield and the nominal bond yield. Asness (2000) shows that co-movements are also driven by changes in investors' risk perceptions. Sharpe (2002) provides evidence that high inflation presages either high long-run real equity returns or low long-run real earnings growth, both consistent with a high contemporaneous earnings yield. Bekaert and Engstrom (2010) contend that a large part of the co-variation is better explained by the high incidence of stagflations than by money illusion. Wei (2010) describes a channel by which a technology shock moves both inflation and dividend yields in the same direction, resulting in a positive correlation between the two. Lee (2010) finds that a two-regime model is more compatible with both the post–World War II negative relation between stock returns and inflation and the pre-war positive relation between them.

Issues with Accounting Data. Because information is frequently costly to obtain and process, a concern is that equity investors may incorrectly adjust accounting information for the effects of inflation. From 1979 to 1986, the Financial Accounting Standards Board (FASB) experimented with inflation accounting, which required companies to include supplemental constant dollar and current cost accounting information in their annual reports. Statement of Financial Accounting Standards (FAS) No. 33, *Financial Reporting and Changing Prices*, contended that inflation caused historical cost financial statements to show illusory profits, thereby masking the erosion of capital.

Much of the related research during this era addresses the question of whether the use of the supplemental accounting information is associated with short-term equity returns. This era was the heyday of the efficient market hypothesis, and much of the research follows the reasoning of Beaver (1981), who contends that markets are efficient with respect to some specific information set if prices behave as if everyone knows that information. Gheyara and Boatsman (1980), Ro (1980), and Beaver, Griffin, and Landsman (1983) find that replacement cost data are not useful in predicting returns. With little protest, FAS No. 33 was withdrawn in 1986 and replaced with FAS No. 89, which encourages, but does not require, companies to disclose supplementary information regarding the effects of changing prices.

Evidence that followed suggests that the decision to rescind FAS No. 33 may have been premature. Bublitz, Frecka, and McKeown (1985) find significant, incremental explanatory power in inflation-adjusted variables beyond what was provided by historical-cost variables. Bildersee and Ronen (1987) show that current-cost data have

incremental explanatory power on stock prices. Sami, Curatola, and Trapnell (1989) find that inflation-adjusted earnings measures outperform historic-cost earnings in terms of their ability to predict changes in stock prices.

More recent research has also suggested that inflation adjustments to financial statement data are useful. Hughes, Liu, and Zhang (2004) note that inflation creates an earnings illusion as an artifact of the mismatching of expenses based on allocations of historical costs with current revenues in determining earnings. Wilcox (2007) and Palkar and Wilcox (2009) argue that accounting adjustments and a debt adjustment are necessary before reported earnings can be considered real. They also show how these adjustments are useful in predicting future real equity returns. Konchitchki (2011) finds that unrecognized inflation gains and losses help predict future cash flows and that this information can be used to generate abnormal returns. According to this author, stock prices act as if investors do not fully distinguish between monetary and nonmonetary assets.

Inflation's Impact on the Real Required Return and Real Growth Rate

Rising inflation and its typically adverse impact on unit sales and profit margins will have a dampening effect on real profit growth. Investors may also demand a higher risk premium for shares in the presence of inflation. Both of these effects will reduce share value and violate the assumptions needed for inflation neutrality.

Evidence does suggest that inflation can decrease real growth rates, as early papers by Friedman (1971, 1977) suggest. Cooley and Hansen (1979) find that inflation acts as a distortionary tax. Fischer (1993) finds a negative empirical relationship between growth and inflation. Sarel (1996) specifically tests for the existence of a structural break in the relationship between inflation and growth and uncovers evidence of a significant structural break at an annual inflation rate of 8 percent. Bruno and Easterly (1998) find that, although no cross-sectional correlation exists between long-run averages of economic growth and inflation, a discrete high inflation crisis is associated with low growth and the end of such a crisis is associated with high growth. The results of Khan and Senhadji's (2001) research suggest the existence of a threshold beyond which inflation exerts a negative effect on growth. Aruoba and Diebold (2010) show decreased real activity and increased inflation for recessions driven by adverse supply shocks.

A good deal of research has been dedicated to the relationship between inflation and the equity risk premium. Using data from nine industrialized countries for the period from 1971 to 1980, Solnik (1983) finds a negative relationship between real stock returns and *ex ante* one-period interest rates, which he takes to be a proxy for expected inflation. Chen, Roll, and Ross (1986) specify unexpected shocks to inflation as a factor that affects stock market returns. Boudoukh, Richardson, and Whitelaw (1994) provide evidence that stock returns of noncyclical industries tend to covary positively with expected inflation, whereas the reverse holds for cyclical industries.

Flannery and Protopapadakis (2002) employ a generalized autoregressive conditional heteroscedasticity (GARCH) model to identify which macroeconomic surprises, out of 17 candidates, influence realized equity returns or their conditional volatility. They find a relationship between market returns and surprises in the Consumer Price Index, the Producer Price Index, and the monetary aggregate. Brandt and Wang (2003) formulate a consumption-based asset pricing model, and their empirical results support the hypothesis that aggregate risk aversion varies in response to news about inflation. Lin (2009) uses a panel of 16 industrialized Organisation for Economic Co-Operation and Development (OECD) countries and finds that anticipated inflation and inflation uncertainty tend to have insignificant short-run effects, but they do tend to have negative long-run effects on real stock returns. In contrast, they find a negative long-run effect and a positive short-run effect of unanticipated inflation on real stock returns.

This article qualifies for 0.5 CE credits.

Bibliography

Adams, G., G. McQueen, and R. Wood. 2004. "The Effects of Inflation News on High Frequency Stock Returns." *Journal of Business*, vol. 77, no. 3 (July):547–574.

> "Our third question is whether the stock-inflation relationship is state dependent. Our answer is yes. The strength of the relationship is stronger for large stocks when the economy is strong (the economy is operating near capacity) and the news is bad (unexpected increases in inflation). The dependences on the length of the return window, the size of the stock, the strength of the economy, and the type of inflation news that we document helps explain why prior researchers found different answers to the question, Do stocks respond to inflation news?" (p. 571)

Ammer, J. 1994. "Inflation, Inflation Risk, and Stock Returns." Federal Reserve Board, International Finance Discussion Papers No. 464 (April):1–43.

> "This paper investigates the empirical relation between inflation and stock returns in ten industrialized countries, with a focus on the implications for links between inflation and the macroeconomy. The stock return decomposition of Campbell and Shiller (1988) is used to determine the extent to which the negative contemporaneous stock return associated with a positive inflation surprise is due to (a) lower future real dividends and (b) higher future required real equity returns. The empirical results suggest that generally higher inflation is associated with both lower real dividends and lower required real equity returns in the future. The evidence favors corporate tax-related theories (e.g., Feldstein 1980)—in which distortions in the tax system cause an increase in inflation to raise the firm's effective cost of capital relative to the return earned by investors in the firm—relative to the 'risk premium story' that has been credited to Tobin (1958). However, for the United States and the United Kingdom, estimates of the arbitrage pricing theory (APT) model with a conditionally heteroscedastic inflation risk factor suggest that inflation may have increased the average real cost of equity capital by as much as fifty basis points." (p. 1)

Aruoba, S., and F. Diebold. 2010. "Real-Time Macroeconomic Monitoring: Real Activity, Inflation, and Interactions." *American Economic Review*, vol. 100, no. 2 (May):20–24.

> "We sketch a framework for monitoring macroeconomic activity in real-time and push it in new directions. In particular, we focus not only on real activity, which has received most attention to date, but also on inflation and its interaction with real activity. As for the recent recession, we find that (1) it likely ended around July 2009; (2) its most extreme aspects concern a real activity decline that was unusually long but less unusually deep, and an inflation decline that was unusually deep but brief; and (3) its real activity and inflation interactions were strongly positive, consistent with an adverse demand shock." (p. 1)

Asikoglu, Y., and M.R. Ercan. 1992. "Inflation Flow-Through and Stock Prices." *Journal of Portfolio Management*, vol. 18, no. 3 (Spring):63–68.

> "This article investigates the relationship between inflation and stock prices at the industry level for the United States economy, using the flow through constant hypothesis of Estep and Hanson. In this hypothesis, the flow-through constant represents the fraction of inflation that flows through to profit growth and plays a key role in determining the sensitivity of the stock value changes in inflation. Specifically, the negative effect of a rise in inflation on a firm's share price will be inversely related to its flow-through ability. The empirical evidence presented strongly suggests the presence of a flow-through effect in equity valuation." (p. 63)

Asness, C. 2000. "Stocks versus Bonds: Explaining the Equity Risk Premium." *Financial Analysts Journal*, vol. 56, no. 2 (March/April):96–113.

"From the 19th century through the mid-20th century, the dividend yield (dividends/price) and earnings yield (earnings/price) on stocks generally exceeded the yield on long-term U.S. government bonds, usually by a substantial margin. Since the mid-20th century, however, the situation has radically changed. In addressing this situation, I argue that the difference between stock yields and bond yields is driven by the long-run difference in volatility between stocks and bonds. This model fits 1871–1998 data extremely well. Moreover, it explains the currently low stock market dividend and earnings yields. Many authors have found that although both stock yields forecast stock returns, they generally have more forecasting power for long horizons. I found, using data up to May 1998, that the portion of dividend and earnings yields explained by the model presented here has predictive power only over the long term whereas the portion not explained by the model has power largely over the short term." (p. 96)

———. 2003. "Fight the Fed Model." *Journal of Portfolio Management*, vol. 30, no. 1 (Fall):11–24.

"The 'Fed model' is a popular yardstick for judging whether the stock market is fairly valued. It compares the stock market's earnings yield to the long-term government bond yield, while more traditional methods evaluate stock market valuation without regard to the level of interest rates. The Fed model is theoretically flawed, as it compares a real number to a nominal number, ignoring the fact that over the long term nominal earnings generally move in tandem with inflation. The crucible for testing a valuation indicator is how well it forecasts long-term returns, and the Fed model fails this test—traditional methods ace it. Lack of predictive ability aside, investors have indeed historically required a higher stock market P/E when nominal interest rates have been lower. This does not imply that the Fed model is valid, rather only that investors have historically followed it, perhaps in error. The relationship of stock and bond market yields is more complicated than conceived by the Fed model, varying systematically with perceptions of long-term stock and bond market risk. Addition of risk to the Fed model solves the puzzle of why stocks outperformed bonds for the first half of the 20th century, but have underperformed bonds since." (p. 11)

Barnes, M., J. Boyd, and B. Smith. 1999. "Inflation and Asset Returns." *European Economic Review*, vol. 43, no. 4–6 (April):737–754.

"Sustained inflation is detrimental to long-run growth and the financial system. A recent theoretical literature suggests that high inflation implies low real returns on assets. These low returns exacerbate informational frictions, interfering with the functioning of financial markets and the allocation of investment. We investigate the plausibility of an inverse relationship between inflation and real returns. Inflation and nominal equity returns are negatively correlated or uncorrelated for all low-to-moderate inflation economies examined. Safe nominal rates of return and inflation are only weakly positively correlated. However, for high inflation economies inflation and nominal returns are strongly positively correlated." (p. 737)

Basak, S., and H. Yan. 2010. "Equilibrium Asset Prices and Investor Behaviour in the Presence of Money Illusion." *Review of Economic Studies*, vol. 77, no. 3 (March):914–936.

"This article analyses the implications of money illusion for investor behaviour and asset prices in a securities market economy with inflationary fluctuations. We provide a belief-based formulation of money illusion which accounts for the systematic mistakes in evaluating real and nominal quantities. The impact of money illusion on security prices and their dynamics is demonstrated to be considerable even though its welfare cost on investors is small in typical environments. A money-illusioned investor's real consumption is shown to generally depend on the price level, and specifically to decrease in the price level. A general-equilibrium analysis in the presence of money illusion generates implications that are consistent with several empirical regularities. In particular, the real bond yields

and dividend price ratios are positively related to expected inflation, the real short rate is negatively correlated with realized inflation, and money illusion may induce predictability and excess volatility in stock returns. The basic analysis is generalized to incorporate heterogeneous investors with differing degrees of illusion." (p. 914)

Beaver, W. 1981. "Market Efficiency." *Accounting Review*, vol. 56, no. 1 (January):23–37.

"Efficient market research arose in response to allegations from the professional investment community and critics of financial accounting, and it preceded a formal, conceptual development of market efficiency. Several ambiguities exist with respect to previous definitions of market efficiency. Market efficiency is defined here in terms of the equality of security prices under two information configurations (i.e., with and without universal access to the information system of interest). Casually, a securities market is efficient with respect to an information system if and only if security prices act as if everyone knows that information system. If this condition holds, prices are said to 'fully reflect' the information system." (p. 23)

Beaver, W., P. Griffin, and W. Landsman. 1983. "How Well Does Replacement Cost Income Explain Stock Return?" *Financial Analysts Journal*, vol. 39, no. 2 (March/April):26–30, 39.

"In the September/October 1979 issue of this journal, Easman, Falkenstein, Weil, and Guy presented evidence to support the claim that changes in sustainable net income (historical cost net income less realized holding gains) correlate better with annualized stock return than changes in reported historical cost net income. This article reexamines that claim using, primarily, SEC replacement cost data for 1976–78 derived from Accounting Series Release No. 190 and, secondarily, inflation adjusted earnings for 1972–77 published by Duff and Phelps' *Inflation Accounting Research Service*. The basic result is that current replacement cost (sustainable) income provides no incremental explanatory power, given historical cost earnings. However, the converse does not hold. In other words, historical cost earnings explain variation in stock return beyond that accounted for by replacement cost income. These findings are consistent with the contention that replacement cost income may be perceived as a garbled version of historical cost earnings." (p. 26)

Bekaert, G., and E. Engstrom. 2010. "Inflation and the Stock Market: Understanding the 'Fed Model'." *Journal of Monetary Economics*, vol. 57, no. 3 (April):278–294.

"The so-called Fed model postulates that the dividend or earnings yield on stocks should equal the yield on nominal Treasury bonds, or at least that the two should be highly correlated. In US data there is indeed a strikingly high time series correlation between the yield on nominal bonds and the dividend yield on equities. This positive correlation is often attributed to the fact that both bond and equity yields comove strongly and positively with expected inflation. Contrary to some of the extant literature, we show that this effect is consistent with modern asset pricing theory incorporating uncertainty about real growth prospects and habit-based risk aversion. In the US, high expected inflation has tended to coincide with periods of heightened uncertainty about real economic growth and unusually high risk aversion, both of which rationally raise equity yields." (p. 278)

Benderly, J., and B. Zwick. 1985. "Inflation, Real Balances, Output, and Real Stock Returns." *American Economic Review*, vol. 75, no. 5 (December):1115–1123.

"Fama (1981) argues that, in efficient and forward-looking markets, real returns should be based on expectations about real variables, such as future output. Any inverse inflation–real return correlation must reflect an inverse relation between inflation and future output growth, which Fama proceeds to explain as an effect of future output growth on current inflation via a money demand model. We have presented stronger support than Fama for his argument that, given future output growth, inflation exerts no independent effect on real stock returns. We also presented an alternative explanation of the

inverse output–inflation relationship. According to our explanation, the inverse relationship between inflation and output runs from current inflation to future output via a real balance effect. Regardless of the direction of causality between inflation and output growth, our evidence and interpretation parallels Fama in suggesting that the stock market efficiently forecasts future output growth." (p. 1122)

Bernard, V.L. 1986. "Unanticipated Inflation and the Value of the Firm." *Journal of Financial Economics*, vol. 15, no. 3 (March):285–321.

"Evidence presented here indicates that the relationship between stock returns and unexpected inflation differs systematically across firms. The differences are shown to be consistent with cross-sectional variation in firms' nominal contracts (monetary claims and depreciation tax shields). The differences are also partially explained by proxies for underlying firm characteristics that could create interaction between unexpected inflation and operating profitability. Finally, much if not most of the differences appear to arise because unexpected inflation is correlated with changes in expected aggregate real activity, the effects of which tend to vary across firms according to their systematic risk." (p. 285)

Bildersee, J., and J. Ronen. 1987. "Stock Returns and Real Activity in an Inflationary Environment: The Informational Impact of FAS No. 33." *Contemporary Accounting Research*, vol. 4, no. 1 (Fall):89–110.

"This paper empirically assesses the degree to which current cost data as required by Financial Accounting Standards Statement No. 33 might implicitly be used by equity market participants. Studies to date, focusing on income measures, documented little or no effect of the data on prices. We argue here that income was the wrong focus. Instead, because current costs can be used to construct quantity indexes and hence measure real productive growth of the firm, the focus should be on the test of association between real productivity (obtained by use of current cost data) and stock returns rather than between income measures and stock returns. Therefore, this paper tests for whether growth measure (of real productive output) which can be obtained by utilizing current cost information and which cannot be obtained without such information, can explain cross-sectional variation in security returns beyond measures based on historical costs. Returns should be more highly associated with current cost based measures of real productive growth than with similar measures based on historical cost, if the current cost data have value. Like the time-series macroeconomic analysis done by Fama (1981), our cross-sectional microeconomic analysis relying on current cost accounting data suggests that security returns are positively related to real productive activity. Moreover, the tests seem to suggest that current cost data, on the margin, reflect productive activity information that may not be already contained in historical cost accounting data." (p. 89)

Bodie, Z. 1976. "Common Stocks as a Hedge Against Inflation." *Journal of Finance*, vol. 31, no. 2 (June):459–470.

"Using annual, quarterly and monthly data for the twenty year period 1953 to 1972, these parameters were estimated under a number of different assumptions about the stochastic process generating the data. The regression results obtained in deriving the estimates seem to indicate that, contrary to a commonly held belief among economists, the real return on equity is negatively related to both anticipated and unanticipated inflation, at least in the short run. This negative correlation leads to the surprising and somewhat disturbing conclusion that to use common stocks as a hedge against inflation, one must sell them short." (p. 469)

Boudoukh, J., and M. Richardson. 1993. "Stock Returns and Inflation: A Long-Horizon Perspective." *American Economic Review*, vol. 83, no. 5 (December):1346–1355.

"Given the relatively low correlation between U.S. and U.K. stock markets, the empirical results describing the relation between nominal returns and inflation are remarkably similar. In conjunction with (i) the evidence across subperiods, (ii) the consistency in results using both ex ante and ex post inflation, and (iii) the similarities using different sets of instruments, this paper provides strong support

for a positive relation between nominal stock returns and inflation at long horizons. To the extent that researchers develop theories to explain the negative correlation at short horizons, these models should also be consistent with the evidence presented here." (p. 1354)

Boudoukh, J., M. Richardson, and R. Whitelaw. 1994. "Industry Returns and the Fisher Effect." *Journal of Finance*, vol. 49, no. 5 (December):1595–1615.

"We investigate the cross-sectional relation between industry-sorted stock returns and expected inflation, and we find that this relation is linked to cyclical movements in industry output. Stock returns of noncyclical industries tend to covary positively with expected inflation, while the reverse holds for cyclical industries. From a theoretical perspective, we describe a model that captures both (i) the cross-sectional variation in these relations across industries, and (ii) the negative and positive relation between stock returns and inflation at short and long horizons, respectively. The model is developed in an economic environment in which the spirit of the Fisher model is preserved." (p. 1595)

Brandt, M., and K. Wang. 2003. "Time-Varying Risk Aversion and Unexpected Inflation." *Journal of Monetary Economics*, vol. 50, no. 7 (October):1457–1498.

"We formulate a consumption-based asset pricing model in which aggregate risk aversion is time-varying in response to both news about consumption growth (as in a habit formation model) and news about inflation. We estimate our model and explore its pricing implications for the term structure of interest rates and the cross-section of stock returns. Our empirical results support the hypothesis that aggregate risk aversion varies in response to news about inflation. The induced time-variation in risk aversion does not appear to proxy for inflation uncertainty or economic growth." (p. 1457)

Bruno, M., and W. Easterly. 1998. "Inflation Crises and Long-Run Growth." *Journal of Monetary Economics*, vol. 41, no. 1 (February):3–26.

"Recent articles in the new growth literature find that growth and inflation are negatively related, a finding that is usually thought to reflect a long-run relationship. But the inflation–growth correlation is only present with high frequency data and with extreme inflation observations; there is no cross-sectional correlation between long-run averages of growth and inflation. We propose that examination of discrete high inflation crises (periods when inflation is above some threshold, which we propose to be 40% annual) helps unravel these empirical paradoxes. We establish a robust finding that growth falls sharply during discrete high inflation crises, then recovers rapidly and strongly after inflation falls." (p. 3)

Bublitz, B., T. Frecka, and J. McKeown. 1985. "Market Association Tests and FASB Statement No. 33 Disclosures: A Reexamination." *Journal of Accounting Research*, vol. 23, supplement:1–23.

"We conclude, with suitable caveats, that *Statement No. 33* disclosures are associated, after controlling for historical cost, with the information set used by the market to establish security prices. Such association is a necessary, but not sufficient, condition for the data to be useful in a market setting. Association tests like those done in this study are not designed to provide a final determination about the usefulness of the data." (pp. 22–23)

Campbell, J., and T. Vuolteenaho. 2004. "Inflation Illusion and Stock Prices." NBER Working Paper 10263 (February):1–18.

"We empirically decompose the S&P 500's dividend yield into (1) a rational forecast of long-run real dividend growth, (2) the subjectively expected risk premium, and (3) residual mispricing attributed to the market's forecast of dividend growth deviating from the rational forecast. Modigliani and Cohn's (1979) hypothesis and the persistent use of the 'Fed model' by Wall Street suggest that the stock market incorrectly extrapolates past nominal growth rates without taking into account the impact of time-varying inflation. Consistent with the Modigliani–Cohn hypothesis, we find that the level of inflation explains almost 80% of the time-series variation in stock-market mispricing." (p. 1)

Chen, N., R. Roll, and S. Ross. 1986. "Economic Forces and the Stock Market." *Journal of Business*, vol. 59, no. 3 (July):383–403.

> "This paper tests whether innovations in macroeconomic variables are risks that are rewarded in the stock market. Financial theory suggests that the following macroeconomic variables should systematically affect stock market returns: the spread between long and short interest rates, expected and unexpected inflation, industrial production, and the spread between high- and low-grade bonds. We find that these sources of risk are significantly priced. Furthermore, neither the market portfolio nor aggregate consumption are priced separately. We also find that oil price risk is not separately rewarded in the stock market." (p. 383)

Chordia, T., and L. Shivakumar. 2005. "Inflation Illusion and Post-Earnings-Announcement Drift." *Journal of Accounting Research*, vol. 43, no. 4 (September):521–556.

> "This paper examines the cross-sectional implications of the inflation illusion hypothesis for the post-earnings-announcement drift. The inflation illusion hypothesis suggests that stock market investors fail to incorporate inflation in forecasting future earnings growth rates, and this causes firms whose earnings growths are positively (negatively) related to inflation to be undervalued (overvalued). We argue and show that the sensitivity of earnings growth to inflation varies monotonically across stocks sorted on standardized unexpected earnings (SUE) and, consistent with the inflation illusion hypothesis, show that lagged inflation predicts future earnings growth, abnormal returns, and earnings announcement returns of SUE-sorted stocks. Interestingly, controlling for the return predictive ability of inflation weakens the ability of lagged SUE to predict future returns of SUE-sorted stocks." (p. 521)

Cohen, R., C. Polk, and T. Vuolteenaho. 2005. "Money Illusion in the Stock Market: The Modigliani-Cohn Hypothesis." NBER Working Paper 11018 (January):1–36.

> "Modigliani and Cohn [1979] hypothesize that the stock market suffers from money illusion, discounting real cash flows at nominal discount rates. While previous research has focused on the pricing of the aggregate stock market relative to Treasury bills, the money-illusion hypothesis also has implications for the pricing of risky stocks relative to safe stocks. Simultaneously examining the pricing of Treasury bills, safe stocks, and risky stocks allows us to distinguish money illusion from any change in the attitudes of investors towards risk. Our empirical results support the hypothesis that the stock market suffers from money illusion." (p. 1)

Cooley, T., and G. Hansen. 1979. "The Inflation Tax in a Real Business Cycle Model." *American Economic Review*, vol. 79, no. 4 (September):733–748.

> "Money is incorporated into a real business cycle model using a cash-in-advance constraint. The model economy is used to analyze whether the business cycle is different in high inflation and low inflation economies and to analyze the impact of variability in the growth rate of money. In addition, the welfare cost of the inflation tax is measured and the steady-state properties of high and low inflation economies are compared." (p. 733)

Fama, E. 1981. "Stock Returns, Real Activity, Inflation, and Money." *American Economic Review*, vol. 71, no. 4 (June):545–565.

> "The hypothesis of this paper is that the negative relations between real stock returns and inflation observed during the post-1953 period are the consequence of proxy effects. Stock returns are determined by forecasts of more relevant real variables, and negative stock return-inflation relations are induced by negative relations between inflation and real activity." (p. 563)

Fama, E., and G. Schwert. 1977. "Asset Returns and Inflation." *Journal of Financial Economics*, vol. 5, no. 2 (November):115–146.

> "We estimate the extent to which various assets were hedges against the expected and unexpected components of the inflation rate during the 1953-71 period. We find that U.S. government bonds and bills were a complete hedge against expected inflation, and private residential real estate was a complete hedge against both expected and unexpected inflation. Labor income showed little short-term relationship with either expected or unexpected inflation. The most anomalous result is that common stock returns were negatively related to the expected component of the inflation rate, and probably also to the unexpected component." (p. 115)

Fehr, E., and J. Tyran. 2001. "Does Money Illusion Matter?" *American Economic Review*, vol. 91, no. 5 (December):1239–1262.

> "This paper shows that a small amount of individual-level money illusion may cause considerable aggregate nominal inertia after a negative nominal shock. In addition, our results indicate that negative and positive nominal shocks have asymmetric effects because of money illusion. While nominal inertia is quite substantial and long lasting after a negative shock, it is rather small after a positive shock." (p. 1239)

Feinman, J. 2005. "Inflation Illusion and the (Mis)pricing of Assets and Liabilities." *Journal of Investing*, vol. 14, no. 2 (Summer):29–36.

> "Inflation, crucial to people's economic and financial decisions, is often handled improperly in conventional valuation frameworks. Forecasts of future nominal cash flows are not always based on the same expected rate of inflation that is in the nominal interest rate used to discount those cash flows. This can lead to mispricing of assets and liabilities, especially when nominal interest rates and expected inflation move outside recent norms." (p. 29)

Feldstein, M. 1980. "Inflation and the Stock Market." *American Economic Review*, vol. 70, no. 5 (December): 839–847.

> "This paper discusses a crucial cause of the failure of share prices to rise during a decade of substantial inflation. Indeed, the share value per dollar of pretax earnings actually fell from 10.82 in 1967 to 6.65 in 1976. The analysis here indicates that this inverse relation between higher inflation and lower share prices during the past decade was not due to chance or to other unrelated economic events. On the contrary, an important adverse effect of increased inflation on share prices results from basic features of the current U.S. tax laws, particularly historic cost depreciation and the taxation of nominal capital gains." (p. 839)

Fischer, S. 1993. "The Role of Macroeconomic Factors in Growth." *Journal of Monetary Economics*, vol. 32, no. 3 (December):485–512.

> "Using a regression analog of growth accounting, I present cross-sectional and panel regressions showing that growth is negatively associated with inflation, large budget deficits and distorted foreign exchange markets. Supplementary evidence suggests that the causation runs from macroeconomic policy to growth. The framework makes it possible to identify the channels of these effects: inflation reduces growth by reducing investment and productivity growth; budget deficits also reduce both capital accumulation and productivity growth. Examination of exceptional cases shows that while low inflation and small deficits are not necessary for high growth even over long periods, high inflation is not consistent with sustained growth." (p. 485)

Fisher, I. 1928. *The Money Illusion*. New York: Adelphi Company.

> "Thus, we Americans are no exception in regard to the 'Money Illusion.' An American is quite lost if he tries to think of the dollar as varying. He cannot think easily of anything by which to measure it. Even with our gold standard we have a dollar fluctuating in buying power. Yet we think of the dollar as fixed only in the sense that it is redeemable in a fixed number of grains of gold. It is not fixed in the amount of goods and benefits it can command." (pp. 10–11)

———. 1930. *The Theory of Interest: As Determined by Impatience to Spend Income and Opportunity to Invest It*. New York: Macmillan Company.

> "The theoretical relation existing between interest and appreciation implies, then, that the rate of interest is always relative to the standard in which it is expressed. The fact that interest expressed in money is high, say 15 per cent, might conceivably indicate merely that general prices are expected to rise (i.e., money depreciate) at the rate of 10 per cent, and that the rate of interest expressed in terms of goods is not high, but only about 5 per cent." (pp. 41–42)

Flannery, M., and A. Protopapadakis. 2002. "Macroeconomic Factors Do Influence Aggregate Stock Returns." *Review of Financial Studies*, vol. 15, no. 3 (Summer):751–782.

> "Stock market returns are significantly correlated with inflation and money growth. The impact of real macroeconomic variables on aggregate equity returns has been difficult to establish, perhaps because their effects are neither linear nor time invariant. We estimate a GARCH model of daily equity returns, where realized returns and their conditional volatility depend on 17 macro series' announcements. We find six candidates for priced factors: three nominal (*CPI, PPI*, and a *Monetary Aggregate*) and three real (*Balance of Trade, Employment Report*, and *Housing Starts*). Popular measures of overall economic activity, such as *Industrial Production* or *GNP* are not represented." (p. 751)

Friedman, M. 1971. "Government Revenue from Inflation." *Journal of Political Economy*, vol. 79, no. 4 (July-August):846–856.

> "What rate of inflation will yield the greatest steady state command over real resources to a government having a monopoly on the issue of fiat money? The usual answer—the rate at which the inflation elasticity of demand for real balances is unity—is correct if real income is constant but wrong if real income is rising. The answer then depends also on the growth rate and on the income elasticity of demand for real balances. The revenue-maximizing rate of inflation is generally lower for growing than for constant real income and may even be negative, that is, deflation. Many actual rates of inflation seem higher than the revenue-maximizing rate." (p. 846)

———. 1977. "Nobel Lecture: Inflation and Unemployment." *Journal of Political Economy*, vol. 85, no. 3 (June):451–472.

> "In the past several decades, professional views on the relation between inflation and unemployment have gone through two stages and are now entering a third. The first was the acceptance of a stable trade-off (a stable Phillips curve). The second was the introduction of inflation expectations, as a variable shifting the short-run Phillips curve, and of the natural rate of unemployment, as determining the location of a vertical long-run Phillips curve. The third is occasioned by the empirical phenomenon of an apparent positive relation between inflation and unemployment. The paper explores the possibility that this relation may be more than coincidental." (p. 451)

Geske, R., and R. Roll. 1983. "The Fiscal and Monetary Linkages between Stock Returns and Inflation." *Journal of Finance*, vol. 38, no. 1 (March):1–33.

> "Contrary to economic theory and common sense, stock returns are negatively related to both expected and unexpected inflation. We argue that this puzzling empirical phenomenon does not indicate causality. Instead, stock returns are negatively related to contemporaneous changes in expected inflation because they signal a chain of events which results in a higher rate of monetary expansion. Exogenous shocks in real output, signaled by the stock market, induce changes in tax revenue, in the deficit, in Treasury borrowing and in Federal Reserve 'monetization' of the increased debt. Rational bond and stock market investors realize this will happen. They adjust prices (and interest rates) accordingly and without delay. Although expected inflation seems to have a negative effect on subsequent stock returns, this could be an empirical illusion, since a spurious causality is induced by a combination of: (a) a reversed adaptive inflation expectations model and (b) a reversed money growth/stock returns model. If the real interest rate is not a constant, using nominal interest proxies for expected inflation is dangerous, since small changes in real rates can cause large and opposite percentage changes in stock prices." (p. 1)

Gheyara, K., and J. Boatsman. 1980. "Market Reaction to the 1976 Replacement Cost Disclosures." *Journal of Accounting and Economics*, vol. 2, no. 2 (August):107–125.

> "A variety of tests are conducted to determine whether replacement cost disclosures as mandated by the Securities and Exchange Commission's Accounting Series Release 190 provided information to capital market agents. In particular, the fiscal year 1976 disclosures made in early 1977 are examined. Information content is assessed by observing distributions of rates of return on common stocks. These distributions are estimated using both time series and cross-sectional data. No evidence of information content is found." (p. 107)

Gonedes, N. 1981. "Evidence on the 'Tax Effects' of Inflation under Historical Cost Accounting Methods." *Journal of Business*, vol. 54, no. 2 (April):227–270.

> "It is often argued that the failure to use indexation (i.e., the use of historical cost accounting methods) implies that real income tax rates will vary directly with rates of inflation. This substantive effect of mere bookkeeping methods is often predicted even though it is recognized to have some adverse implications. This is the 'tax effects of inflation' hypothesis. The major objective of this paper is to examine the descriptive adequacy of this hypothesis using a variety of macroeconomic data for the years 1929-74. My empirical results appear to be substantially inconsistent with the tax-effects hypothesis." (p. 227)

Hughes, J., J. Liu, and M. Zhang. 2004. "Valuation and Accounting for Inflation and Foreign Exchange." *Journal of Accounting Research*, vol. 42, no. 4 (September):731–754.

> "Inflation and foreign exchange raise new issues with respect to accounting representations of equity value. For example, inflation creates an earnings illusion as an artifact of the mismatching of expenses based on allocations of historical costs with current revenues in determining earnings. This mismatching distorts mappings of aggregate earnings and book values into equity value such that value-relevant information is lost. In this article we consider the consequences of inflation and foreign exchange accounting policies, including those contained in accounting standards, on the value relevance of bottom-line accounting numbers. Policies are identified that achieve efficient accounting in the sense that aggregate (comprehensive) earnings and book values are sufficient for an accounting representation of equity value. The linear relations that emerge provide predictions on capitalization coefficients that help explain results of empirical inquiries. As well, our analysis provides a theoretical foundation for policies contained in accounting standards that contributes to the resolution of controversies such as that concerning foreign exchange accounting." (p. 731)

Jaffe, J., and G. Mandelker. 1976. "The 'Fisher Effect' for Risky Assets: An Empirical Investigation." *Journal of Finance*, vol. 31, no. 2 (May):447–458.

"For the period of 1953-1971, the returns on stocks appear to be significantly negatively related to the anticipated rate of inflation, a finding inconsistent with the Fisher effect and possibly suggestive of market inefficiency. This result occurred whether the proxy for expected inflation was either the one month risk-free interest rate or past rates of inflation. However, for the period 1875 to 1970, the yearly returns on stocks appear to be independent of past rates of inflation. Our data also suggest a negative relationship between unanticipated inflation and the returns to common stock, a result consistent with previous theoretical work." (pp. 457–458)

James, C., S. Koreisha, and M. Partch. 1985. "A VARMA Analysis of the Causal Relations among Stock Returns, Real Output, and Nominal Interest Rates." *Journal of Finance*, vol. 40, no. 5 (December):1375–1384.

"Previous research has documented a negative relation between common stock returns and inflation. Recently, Fama and Geske and Roll have argued that this relation results from a more fundamental one between real activity and expected inflation. Stock returns, they argue, signal changes in real activity, which in turn affect expected inflation. However, unlike Fama, Geske and Roll argue that changes in real activity result in changes in money supply growth, which in turn affect expected inflation. Empirical tests have analyzed separately each link in the proposed causal chain. In this article, we investigate simultaneously the relations among stock returns, real activity, inflation, and money supply changes using a vector autoregressive moving average (VARMA) model. Our empirical results strongly support Geske and Roll's reversed causality model." (p. 1375)

Kaul, G. 1987. "Stock Returns and Inflation: The Role of the Monetary Sector." *Journal of Financial Economics*, vol. 18, no. 2 (June):253–276.

"This paper hypothesizes that the relation between stock returns and inflation is caused by the equilibrium process in the monetary sector. More importantly, these relations vary over time in a systematic manner depending on the influence of money demand and supply factors. Post-war evidence from the United States, Canada, the United Kingdom and Germany indicates that the negative stock return–inflation relations are caused by money demand and counter-cyclical money supply effects. On the other hand, pro-cyclical movements in money, inflation, and stock prices during the 1930's lead to relations which are either positive or insignificant." (p. 253)

———. 1990. "Monetary Regimes and the Relation between Stock Returns and Expected Inflation." *Journal of Financial and Quantitative Analysis*, vol. 25, no. 3 (September):307–321.

"This paper analyzes the impact of changes in monetary policy regimes on the relation between stock returns and changes in expected inflation. Post-war evidence from four countries reveals a direct link between these relations and the central banks' operating targets (i.e., money supply or interest rates). Specifically, the post-war negative relations between stock returns and changes in expected inflation are significantly stronger during interest rate regimes." (p. 307)

Keynes, J. 1924. *A Tract on Monetary Reform*. London: Macmillan Company.

"Unemployment, the precarious life of the worker, the disappointment of expectation, the sudden loss of savings, the excessive windfalls to individuals, the speculator, the profiteer—all proceed, in large measure, from the instability of the standard of value." (Preface)

Khan, M., and S. Senhadji. 2001. "Threshold Effects in the Relationship between Inflation and Growth." *IMF Staff Report*, vol. 48, no. 1 (December):1–21.

> "The empirical results strongly suggest the existence of a threshold beyond which inflation exerts a negative effect on growth. The threshold is lower for industrial than for developing countries (the estimates are 1–3 percent and 11–12 percent for industrial and developing countries, respectively, depending on the estimation method). The thresholds are statistically significant at 1 percent or less. The confidence intervals are very tight, which implies that the threshold estimates are very precise." (p. 19)

Konchitchki, Y. 2011. "Inflation and Nominal Financial Reporting: Implications for Performance and Stock Prices." *Accounting Review*, vol. 86, no. 3 (May):1045–1085.

> "The monetary unit assumption of financial accounting assumes a stable currency (i.e., constant purchasing power over time). Yet, even during periods of low inflation or deflation, nominal financial statements violate this assumption. I posit that, while the effects of inflation are not recognized in nominal statements, such effects may have economic consequences. I find that unrecognized inflation gains and losses help predict future cash flows as these gains and losses turn into cash flows over time. I also find significant abnormal returns to inflation-based trading strategies, suggesting that stock prices do not fully reflect the implications of the inflation effects for future cash flows. Additional analysis reveals that stock prices act as if investors do not fully distinguish monetary and nonmonetary assets, which is fundamental to determining the effects of inflation. Overall, this study is the first to show that, although inflation effects are not recognized in nominal financial statements, they have significant economic consequences, even during a period in which inflation is relatively low." (p. 1045)

Lee, B. 1992. "Causal Relations among Stock Returns, Interest Rates, Real Activity, and Inflation." *Journal of Finance*, vol. 47, no. 4 (September):1591–1603.

> "Using a multivariate vector-autoregression (VAR) approach, this paper investigates causal relations and dynamic interactions among asset returns, real activity, and inflation in the postwar United States. Major findings are (1) stock returns appear Granger-causally prior and help explain real activity, (2) with interest rates in the VAR, stock returns explain little variation in inflation, although interest rates explain a substantial fraction of the variation in inflation, and (3) inflation explains little variation in real activity. These findings seem more compatible with Fama (1981) than with Geske and Roll (1983) or with Ram and Spencer (1983)." (p. 1591)

———. 2010. "Stock Returns and Inflation Revisited: An Evaluation of the Inflation Illusion Hypothesis." *Journal of Banking & Finance*, vol. 34, no. 6 (June):1257–1273.

> "Several hypotheses have been proposed to explain the stock return–inflation relation. The Modigliani and Cohn's inflation illusion hypothesis has received renewed attention. Another hypothesis is the two-regime hypothesis. We reexamine these hypotheses using long sample data of the US and international data. We find that the inflation illusion hypothesis can explain the post-war negative stock return–inflation relation, but it is not compatible with the pre-war positive relation. Using a structural VAR identification method, we show that there are two regimes with positive and negative stock return–inflation relations not only in each period of the US but also in every developed country we consider. This seems inconsistent with the inflation illusion hypothesis that predicts only a negative relation." (p. 1257)

Lin, S. 2009. "Inflation and Real Stock Returns Revisited." *Economic Inquiry*, vol. 47, no. 4 (October):783–795.

> "The article uses the (unbalanced) panel data to revisit the effects of expected inflation, unexpected inflation, and inflation uncertainty on real stock returns. The empirical results are obtained via the pooled mean group estimator, which can be applied to I(1) and/or I(0) variables, and can distinguish

long- and short-run effects. Using a panel of 16 industrialized Organization for Economic Cooperation and Development countries over the 1957:Q1 to 2000:Q1 period, we find that anticipated inflation and inflation uncertainty tend to have insignificant short-run effects, while they appear to have negative long-run impacts on real stock returns. Moreover, we find coexistence of a negative long-run effect and a positive short-run effect of unanticipated inflation on real stock returns. These findings help clarify the conflicting conclusions of both empirical and theoretical studies on this issue." (p. 783)

Lintner, J. 1975. "Inflation and Security Returns." *Journal of Finance*, vol. 30, no. 2 (May):259–280.

"Even if the company's unit sales growth and real rates of return on operations and assets and its collection experience are fully maintained at a constant level, this greater relative dependence on outside financing required by an increase in realized inflation during any period will necessarily reduce the value of its outstanding equity, and consequently also reduce the real rate return realized on its equities during the period, because it involves a deadweight dilution of the real returns on owning equities over the period. If the added financing required to maintain real rates of growth is obtained by added debt, the after-tax cost of the debt not otherwise required will directly reduce real returns to equity owners even though the company's real profits are maintained. Alternatively, if the added financing is obtained with new equity issues, even if the new issue price is initially the same, the owners of the previously outstanding shares wind up owning a smaller fraction of the company's total equity, and their real return will have been impaired even though the company's real returns have been fully maintained. Moreover, it should be emphasized that these reductions in real returns on equity ownership occur even though real interest rates and returns on alternative investments are unchanged. In particular, the adverse effects of inflation on equity prices and real returns because of the deadweight real financing costs involved are in addition to any negative impacts of an increase in interest rates." (p. 274)

McDevitt, C. 1989. "The Role of the Nominal Tax System in the Common Stock Returns/Expected Inflation Relationship." *Journal of Monetary Economics*, vol. 24, no. 1 (July):93–107.

"Recent empirical evidence suggests that common stock returns and expected inflation are negatively related. This paper focuses on one explanation of this relationship, a nominal tax approach. According to this theory, in countries with specific nominal tax components to their tax systems, inflation increases the effective tax rate, thereby lowering after-tax returns. Analyzing monthly data for Germany, Japan, the Netherlands, Sweden, and the U.S. for the period 1960–1981, and annual data for the U.K. and U.S. for the period 1870–1980, I find little empirical support for the nominal tax approach." (p. 93)

McQueen, G., and V. Roley. 1993. "Stock Prices, News, and Business Conditions." *Review of Financial Studies*, vol. 6, no. 3:683–707.

"Previous research finds that fundamental macroeconomic news has little effect on stock prices. We show that after allowing for different stages of the business cycle, a stronger relationship between stock prices and news is evident. In addition to stock prices, we examine the effect of real activity news on proxies for expected cashflows and equity discount rates. We find that when the economy is strong the stock market responds negatively to news about bigger real economic activity. This negative relation is caused by the larger increase in discount rates relative to expected cashflows." (p. 683)

Modigliani, F., and R. Cohn. 1979. "Inflation, Rational Valuation and the Market." *Financial Analysts Journal*, vol. 35, no. 2 (March/April):24–44.

> "Our analysis provides evidence that investors do in fact tend to commit two major, inflation-induced errors in evaluating corporate assets:
>
> (1) They fail to correct reported accounting profits for the gain accruing to stockholders as a result of the real depreciation in nominal corporate liabilities. Because inflation (especially in the U.S.) has tended to produce a commensurate rise in nominal interest rates, it has also tended to reduce accounting profits, even if correctly measured profits have in fact kept up with inflation. (2) They tend to capitalize equity earnings at a rate that follows the nominal rate, whereas (as has long been known to students of finance) the economically sound procedure is to capitalize them at the real rate—that is, at the nominal rate less that portion of it representing the inflation premium or, alternatively, the compensation due to creditors for the expected real devaluation of their debt claims." (p. 25)

Nelson, C. 1976. "Inflation and Rates of Return on Common Stock." *Journal of Finance*, vol. 31, no. 2 (May): 471–483.

> "The purpose of this paper is to investigate empirically the relation between returns on common stocks and the rate of inflation over the post-war period. The evidence presented does not support the Fisher hypothesis but rather suggests that a negative relation between returns and both anticipated rates of inflation and unanticipated changes in the rate of inflation has prevailed over the post-war period. Following up the implication of a negative relation with anticipated inflation, post-sample prediction tests for 1973 and the first half of 1974 indicate that past rates of inflation could have been used to pursue trading rules that generated higher returns than a buy-and-hold policy during that period." (p. 471)

Palkar, D., and S. Wilcox. 2009. "Adjusted Earnings Yields and Real Rates of Return." *Financial Analysts Journal*, vol. 65, no. 5 (September/October):66–79.

> "An accurate forecast of real return requires that accounting and debt adjustments be made to reported earnings. This article presents methodologies that investors can use to estimate the accounting and debt adjustments for individual companies and offers evidence, derived from a predictive regression model, that investors should consider these adjustments important. The article also reviews the use of nonfinancial corporate debt and makes the case that investors should view the use of debt by nonfinancial companies more positively than they currently do." (p. 66)

Pearce, D., and V. Roley. 1983. "The Reaction of Stock Prices to Unanticipated Changes in Money: A Note." *Journal of Finance*, vol. 38, no. 4 (September):1323–1333.

> "This paper has examined the short-run reaction of stock prices to weekly money supply announcements. Several conclusions emerge from this empirical investigation. First, stock prices respond only to the unanticipated change in the money supply as predicted by the efficient markets hypothesis. Second, an unanticipated increase in the announced money supply depresses stock prices while an unanticipated decrease elevates stock prices." (p. 1332)

———. 1988. "Firm Characteristics, Unanticipated Inflation, and Stock Returns." *Journal of Finance*, vol. 43, no. 4 (September):965–981.

> "The empirical results indicated that time-varying firm characteristics related to inflation predominately determine the effect of unanticipated inflation on a stock's rate of return. Moreover, the net effect could be either positive or negative. A firm's debt–equity ratio and its inventories, when FIFO inventory accounting is used, appear to be particularly important in determining the response. A firm's market beta also is a significant factor, but the associated effect is smaller in comparison. These results therefore offer support to the nominal-contracting hypothesis, in contrast to those of French, Ruback, and Schwert (1983) and Bernard (1980). Given the significant role of debt–equity ratios in determining a stock's response, the results also contradict the investor-irrationality hypothesis presented by Modigliani and Cohn (1979)." (p. 980)

Ram, R., and D. Spencer. 1983. "Stock Returns, Real Activity, Inflation, and Money: Comment." *American Economic Review*, vol. 73, no. 3 (June):463–470.

> "The evidence adduced by Fama has the apparent consequence of calling into question conventional macroeconomic theories of the Phillips curve which suggest a positive relationship between inflation and real activity. The purpose of this comment is to take issue with that conclusion, and thus with Fama's explanation of the relationship between real stock returns and inflation. We find considerable empirical evidence which is inconsistent with the world described by Fama, but generally consistent with conventional macroeconomic theory." (p. 463)

Ritter, J., and R. Warr. 2002. "The Decline of Inflation and the Bull Market of 1982–1999." *Journal of Financial and Quantitative Analysis*, vol. 37, no. 1 (March):29–61.

> "If stocks were severely undervalued in the late 1970s and early 1980s, then the bull market starting in 1982 was partly just a correction to more normal valuation levels. This paper tests the hypothesis that investors suffer from inflation illusion, resulting in the undervaluation of equities in the presence of inflation, with levered firms being undervalued the most. Using firm level data and a residual income/EVA model, we find evidence that errors in the valuation of levered firms during inflationary times result in depressed stock prices. Our misvaluation measure can be used with expected inflation to make statistically reliable predictions for real returns on the Dow during the subsequent year. Our model suggests that stocks were overvalued at the end of the 1990s." (p. 29)

Ro, B. 1980. "The Adjustment of Security Returns to the Disclosure of Replacement Cost Accounting Information." *Journal of Accounting and Economics*, vol. 2, no. 2 (August):159–189.

> "In March 1976, the Securities and Exchange Commission (SEC) promulgated Accounting Series Release No. 190 (ASR 190) requiring the disclosure of certain replacement cost (RC) accounting data by its registrants. The purpose of this study is to assess whether the RC disclosure rule had any effect on common stock returns for firms affected by the new rule. Distinguishing the effect of compliance costs from the effect of information in the RC data, we found no sign of a cost effect and no strong evidence of an information effect. This result appears to imply (a) that the burden of the ASR 190 compliance costs was not large enough to induce downward adjustments of the firms' security returns; and (b) that the RC data did not provide new information useful to investors as asserted by the SEC." (p. 159)

Sami, H., A. Curatola, and J. Trapnell. 1989. "Evidence on the Predictive Ability of Inflation-Adjusted Earnings Measures." *Contemporary Accounting Research*, vol. 5, no. 2 (Spring):556–574.

> "The results of prior studies on the information content of inflation-adjusted data in general, and of the SFAS 33 pronouncement in particular, have been mixed. The present study is motivated by the need to address further the relevance of SFAS 33 data to decisions made by security-market participants. The relevance of the SFAS 33 data is assessed in two contexts: (1) the association of security returns with inflation-adjusted and historical cost based earnings, and (2) the SFAS 33 data's ability, in a one-period-ahead prediction of security returns in comparison with the traditional historical cost model. The association test leads to mixed and inconclusive results. The predictive ability test indicates that several inflation-adjusted measures of firms' earnings outperformed the historical cost earnings measure for 1981 and 1982. The latter results were not sensitive to the form of user loss function, sample size, and type of sample. These results may suggest that the recent decision by the FASB to make reporting according to the SFAS 33 pronouncement optional was premature." (p. 556)

Sarel, M. 1996. "Nonlinear Effects of Inflation on Economic Growth." *IMF Staff Papers*, vol. 43, no. 1 (March):199–215.

"This paper examines the possibility of nonlinear effects of inflation on economic growth. It finds evidence of a significant structural break in the function that relates economic growth to inflation. The break is estimated to occur when the inflation rate is 8 percent. Below that rate, inflation does not have any effect on growth, or it may even have a slightly positive effect. When the inflation rate is above 8 percent, however, the estimated effect of inflation on growth rates is significant, robust, and extremely powerful. The paper also demonstrates that when the existence of the structural break is ignored, the estimated effect of inflation on growth is biased by a factor of three." (p. 199)

Schwert, G. 1981. "The Adjustment of Stock Prices to Inflation Information." *Journal of Finance*, vol. 36, no. 1 (March):15–29.

"This paper analyzes the reaction of stock prices to the new information about inflation. Based on daily returns to the Standard and Poor's composite portfolio from 1953-78, it seems that the stock market reacts negatively to the announcement of unexpected inflation in the Consumer Price Index (C.P.I.), although the magnitude of the reaction is small. It is interesting to note that the stock market seems to react at the time of announcement of the C.P.I., approximately one month after the price data are collected by the Bureau of Labor Statistics." (p. 15)

Sharpe, S. 2002. "Reexamining Stock Valuation and Inflation: The Implications of Analysts' Earnings Forecasts." *Review of Economics and Statistics*, vol. 84, no. 4 (November):632–648.

"This paper examines the effect of inflation on stock valuations and expected long-run returns. Ex ante estimates of expected long-run returns are constructed by incorporating analysts' earnings forecasts into a variant of the Campbell-Shiller dividend-price ratio model. The negative relation between equity valuations and expected inflation is found to be the result of two effects: a rise in expected inflation coincides with both lower expected real earnings growth and higher required real returns. The earnings channel mostly reflects a negative relation between expected long-term earnings growth and expected inflation. The effect of expected inflation on required (long-run) real stock returns is also substantial. An increase of one percentage point in expected inflation is estimated to raise required real stock returns about one percentage point, which on average would imply a 20% decline in stock prices. But the inflation factor in expected real stock returns is also in long-term Treasury yields; consequently, expected inflation has little effect on the long-run equity premium." (p. 632)

Siegel, J. 2008. *Stocks for the Long Run*. 4th ed. New York: McGraw-Hill.

"In contrast to the returns of fixed-income assets over long periods of time, the historical evidence is convincing that the returns on stocks over the same time periods have kept pace with inflation. Since stocks are claims on the earnings of real assets—assets whose value is intrinsically related to labor and capital—it is reasonable to expect that their long-term returns will not be influenced by inflation." (p. 199)

Solnik, B. 1983. "The Relation between Stock Prices and Inflationary Expectations: The International Evidence." *Journal of Finance*, vol. 38, no. 1 (March):35–48.

"This paper provides empirical evidence on the relation between stock returns and inflationary expectations for nine countries over the period 1971-80. The Fisherian assumption that real returns are independent of inflationary expectations is soundly rejected for each major stock market of the world. Using interest rates as a proxy for expected inflation, our data provide consistent support for the Geske and Roll model whose basic hypothesis is that stock price movements signal (negative) revisions in inflationary expectations. Finally, a weak real interest rate effect was found for some of these countries." (p. 35)

Stulz, R. 1986. "Asset Pricing and Expected Inflation." *Journal of Finance*, vol. 41, no. 1 (March):209–223.

"This paper provides an equilibrium model in which expected real returns on common stocks are negatively related to expected inflation and money growth. It is shown that the fall in real wealth associated with an increase in expected inflation decreases the real rate of interest and the expected real rate of return of the market portfolio. The expected real rate of return of the market portfolio falls less, for a given increase in expected inflation, when the increase in expected inflation is caused by an increase in money growth rather than by a worsening of the investment opportunity set. The model has empirical implications for the effect of a change in expected inflation on the cross-sectional distribution of asset returns and can help to understand why assets whose return covaries positively with expected inflation may have lower expected returns. The model also agrees with explanations advanced by Fama and Geske and Roll for the negative relation between stock returns and inflation." (p. 209)

Svedsäter, H., A. Gamble, and T. Garling. 2007. "Money Illusion in Intuitive Financial Judgments: Influences of Nominal Representation of Share Prices." *Journal of Socio-Economics*, vol. 36, no. 5 (October):698–712.

"We report two experiments to demonstrate the money illusion in intuitive financial judgments. In Experiment 1 we assess the extent to which the nominal representation affects participants' expectations of changes in share prices following negative or positive financial information. In support of an anticipated bias towards the nominal representation, a lower share price was found to lead to higher expected percentage changes. Experiment 2 investigates equivalent effects for share prices represented in euros or Swedish crowns (approximately equal to 0.1 euro). Here shares represented in the more expensive euro resulted in higher expected percentage changes in share prices, hence replicating the results of Experiment 1. A third experiment was also conducted where we demonstrate how changes of nominal prices affect participants' trading following a split or a reverse split of share prices. The results show that both buyers and sellers were more willing to trade shares after a split, whereas the opposite was true after a reversed split." (p. 698)

Wei, C. 2009. "Does the Stock Market React to Unexpected Inflation Differently across the Business Cycle?" *Applied Financial Economics*, vol. 19, no. 24 (December):1947–1959.

"I find that nominal equity returns respond to unexpected inflation more negatively during contractions than expansions. In particular, returns on firms with lower book-to-market ratio, or of medium size, demonstrate strong asymmetric correlations with unexpected inflation across the business cycle. The cross-sectional correlations of returns on book-to-market and size portfolios with unexpected inflation mostly reflect the heterogeneous factor loadings of these portfolios on one of the Fama–French factors, namely, the excess market return. By examining the cyclical responses to unexpected inflation of the three primitive forces which determine stock prices—the discount rate, the expected growth rate of real activity and the equity risk premium—I find that changes in expected real activity and the equity premium, signaled by unexpected inflation, are important in explaining the asymmetric responses of the stock market to unexpected inflation across the business cycle." (p. 1947)

———. 2010. "Inflation and Stock Prices: No Illusion." *Journal of Money, Credit and Banking*, vol. 42, no. 2–3 (March–April):325–345.

"Campbell and Vuolteenaho (2004) use VAR results to advocate inflation illusion as the explanation for the positive association between inflation and dividend yields. Using a structural approach, we find that a fully rational dynamic general equilibrium model can generate a positive correlation between dividend yields and inflation as observed in the data. The paper describes a channel by which the technology shock moves both inflation and dividend yields in the same direction, resulting in a positive correlation between the two." (p. 325)

Wilcox, S. 2007. "The Adjusted Earnings Yield." *Financial Analysts Journal*, vol. 63, no. 5 (September/October):54–68.

> "This research has made the case that the adjusted earnings yield provides a reasonable estimate of real expected return. Adjustments are made to earnings to (1) convert them to a current-cost (replacement-cost) basis and (2) reflect the benefit that accrues to shareholders from repaying debt with a currency that has been cheapened by inflation. These adjustments are necessary to ensure that expected return is determined as a ratio of current period prices and can, therefore, be considered real." (p. 64)

