Protecting a Portfolio Against Inflation Risk

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DESPITE an absence of visible inflation pressure in the current economic environment, there is broad agreement on the need to protect fund portfolios from the ravages of potential future inflation. Many different asset categories, of which inflation-linked bonds are only the latest, have been proposed as sources of inflation protection. The others include commodities, real estate, precious metals, cash, and various types of equity portfolios including equitized real estate as well as broad market indices. The effectiveness of each of these asset classes as an inflation hedge depends on the investor's liabilities and time horizon, and on the other assets in the portfolio, which together determine the inflation exposure the investor is trying to hedge.

We find that international diversification on a currency-unhedged basis is likely to be useful in hedging the local inflation risk of a typical, equity-dominated balanced portfolio, while commodities and cash are the only assets that appear to provide any appreciable value in hedging the global inflation risk of such portfolios. In the current environment of pre-emptive monetary policy, inflation-linked bonds, such as the Treasury Inflation Protection Securities (TIPS) recently issued by the U.S. Treasury, which are most valuable in the presence of realized inflation, are primarily useful for hedging the risk of reversion to less aggressive monetary policy.

WHAT IS INFLATION RISK?

The problem in addressing inflation risk is that there is not just one kind of inflation risk. First, the inflation risk to which the fund is exposed depends

on its holdings and its time horizon: a short horizon, low risk, predominantly fixed-income investor has an inflation exposure that is very different from that of a longer-term investor who primarily holds equities. Second, the way that asset prices respond to inflation is critically dependent on the way in which monetary policy is conducted (that is, on the monetary policy regime).

Broadly we argue that for an equity-dominated fund portfolio, global diversification is the key protection against inflation in a single country. A diversified portfolio of commodities, on the other hand, is the best protection against a broad global inflation arising from strength in the global economy.

For an equity-dominated fund portfolio, global diversification is the key protection against local inflation in a single country.

In traditional equity-dominated balanced fund portfolios, TIPS are primarily useful in protecting against global stagflations that arise from large negative supply shocks such as the 1973–1975 oil price shock. Such events damage the portfolio in two ways: 1) they destroy the underlying real value of physical capital, hence hurting equity returns by reducing the ability of corporations to generate real earnings; and 2) they erode the real value of nominal assets such as bonds through inflation, unless monetary policy is sufficiently aggressive. We would note, however, that it is hard to find an historical example where such a shock was not commodity based and hence was not also better protected by commodity exposure than by TIPS.[1]

The reasoning that leads to these conclusions begins by examining the interaction of sources of inflationary pressure and the conduct of monetary policy. Most so-called inflation-hedging assets (e.g., TIPS and some forms of real estate), which benefit from high rates of inflation, do poorly if the monetary policy response to the underlying price pressures is timely and aggressive (as the responses have been since the late 1970s, when Paul Volcker took office as chairman of the Federal Reserve).

In contrast, stocks and bonds perform poorly in periods of inflationary pressure regardless of the monetary policy response. For these assets, basically you are "damned if you do and damned if you don't." Once the underlying

price pressures develop, the need to raise interest rates and dampen the economy, and hence profits, will hurt the performance of financial assets regardless of the policy response. The only question is how much of the damage is due to actual realized inflation and how much is due to the high real interest rates and depressed earnings that prevent inflation from being realized.

This approach to analyzing inflation risks reveals that the inflation risk of balanced stock and bond fund portfolios has actually remained roughly the same over the period we studied, even as signs of apparent inflation have largely disappeared. Much of the inflation risk has taken the form of real interest rate risk as the vigor of the policy response that has kept inflation rates low has also generated a large increase in real interest rate volatility.

This shift in the nature of inflation risks also highlights the primary benefit of TIPS at this time: to act as a hedge against a return to the prior monetary policy regime, rather than to hedge against inflation risk in the current regime. In fact, in the current monetary policy regime, the high sensitivity of TIPS to changes in real interest rates may actually represent, for many portfolios, a net increase in inflation risk as we have defined it (i.e., including the real interest rate risk arising from an aggressive policy response to inflationary pressures).

Effective management of inflation risk requires finding ways of dealing with the underlying problem rather than one particular symptom (high rates of observed inflation), or at least making sure that the overall program contains assets that can provide offsetting returns regardless of the monetary policy response. To clarify the investment policy issues involved in managing inflation risk, we examine three issues in detail:

1) changes in monetary policy regimes and how these changes impact the interaction of asset returns and inflation;

2) the distinction between local and global inflation, and how each relates to inflation-hedging strategy; and

3) a quantitative assessment of inflation risk and an assessment of the historical effectiveness of different inflation-hedging assets in the two major monetary regimes that compose our study period.

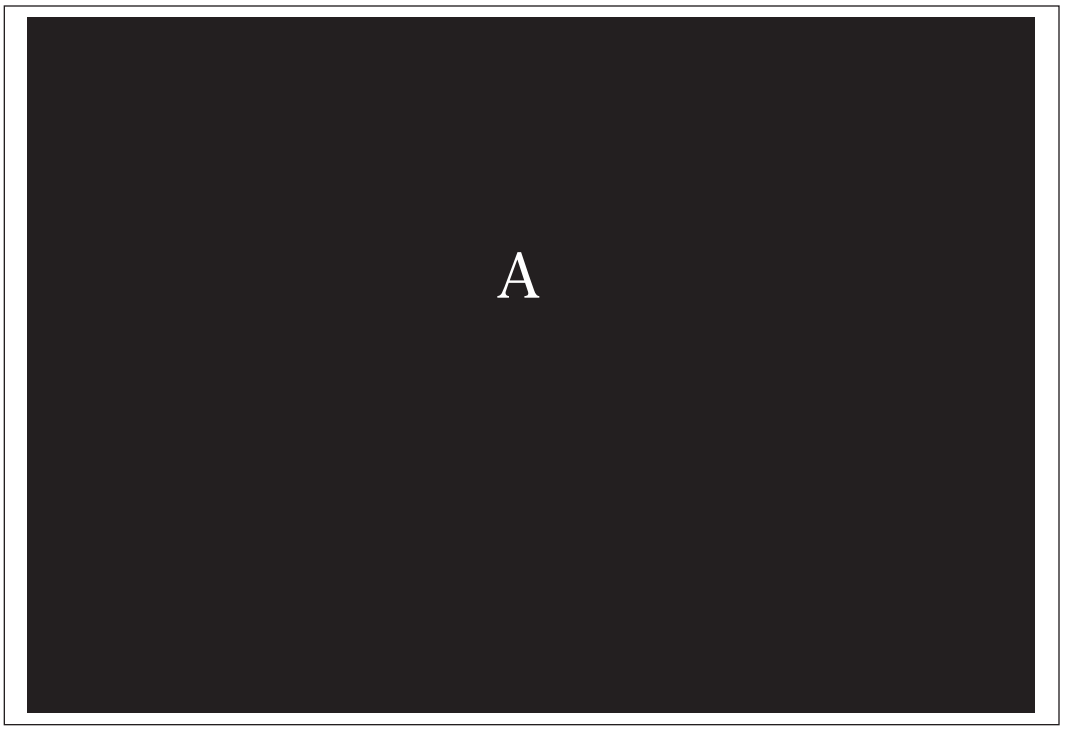
INFLATIONARY RISK AND MONETARY POLICY

To assess inflation risk, we need to understand how the conduct of monetary policy can impact the relationship between inflation and asset returns. The U.S. provides a particularly stark demonstration of this impact as there was a significant change in the conduct of monetary policy between 1979 and 1982.

Prior to 1979, U.S. monetary policy could be characterized as passive. The Federal Reserve waited for inflation to occur before attempting to reverse or arrest the problem by slowing the economy. This "delayed" response (that is, delayed until the inflation actually occurred), in turn, led to a broad upward trend in the rate of inflation.[2]

After 1979, Paul Volcker attacked inflation by forcing the economy into severe recession and severely reducing the actual rate of inflation. He then shifted the focus of monetary policy from responding to inflation to proactively preventing inflation. The result was a substantial increase in stability in the rate of inflation.

Figure 1: 12-Month U.S. CPI Inflation Rate versus 12-Month U.S. Government Bond Return
PANEL 1: JANUARY 1961 TO DECEMBER 1982



Source: Department of Labor and Ibbotson Associates.

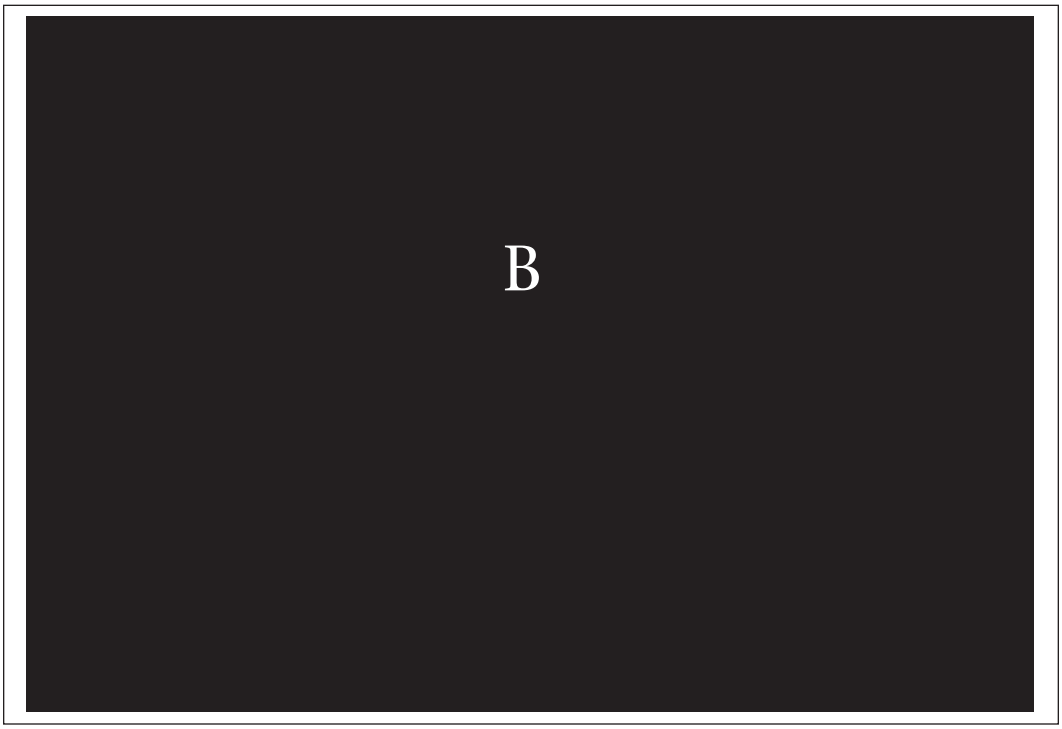
The impact of this change in the conduct of monetary policy on the relationship between inflation and bond returns can be seen in the two panels of Figure 1. Each chart displays the 12-month CPI inflation rate and the 12-month nominal return on U.S. government bonds (see Appendix A for data description). Both charts use the same scale.

Panel 1 covers the period from 1961 to 1982. In this period, inflation and bond market returns are negatively correlated and both series show significant volatility. Each upward swing in inflation drives bond returns down, and each downward swing in inflation results in an upward swing in bond returns.

It is easy to see why, in this period, a perception developed that inflation was the main, if not the only, driver of the bond market. Further, given the considerable volatility in realized inflation in this period, inflation-linked bonds would have been of substantial value to investors.

Panel 2 shows the period from 1983 onward (using the same series and the same scaling), which is the period following the shift in monetary policy

PANEL 2: JANUARY 1983 TO MARCH 1997



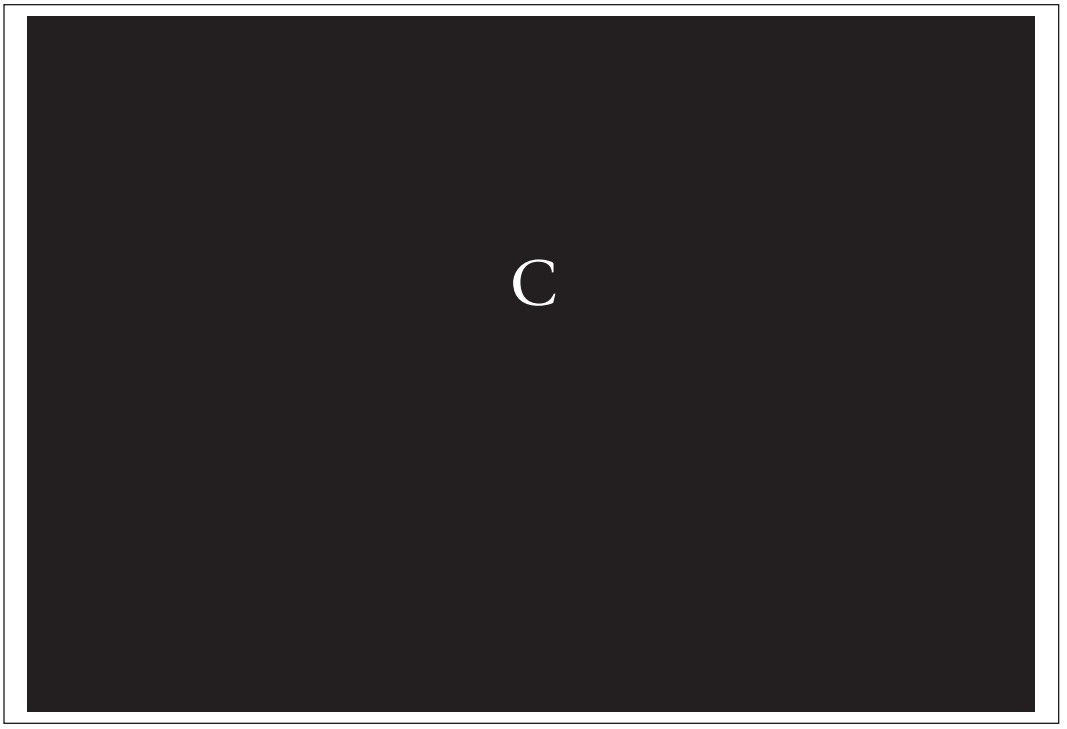
Source: Department of Labor and Ibbotson Associates.

in 1979 and the resulting upheaval during 1980–1982. The story could not be more different from the pre-Volcker period. Volatility in inflation largely disappeared. Bond market volatility, in contrast, increased noticeably (see Table 1, page 70).

The reason for this seeming paradox of reduced inflation volatility and increased bond market volatility is actually quite simple. When the Federal Reserve sought to anticipate inflation pressures and prevent them from becoming embedded in the economy, the result of its actions was to make real interest rates more volatile. Thus, the inflation volatility was transformed into real interest rate volatility.

This shift from the risk of realized inflation to real interest rate risk has the ironic implication that TIPS, a security designed to protect the investor from inflation, may have little value in dealing with inflation risk in the current environment. The reason TIPS lose their value as an inflation hedge in pro-active monetary policy environments is that they only protect the

Figure 2: 12-Month U.S. CPI Inflation Rate versus 12-Month S&P 500 Return
PANEL 1: JANUARY 1961 TO DECEMBER 1982



Source: Department of Labor and Ibbotson Associates.

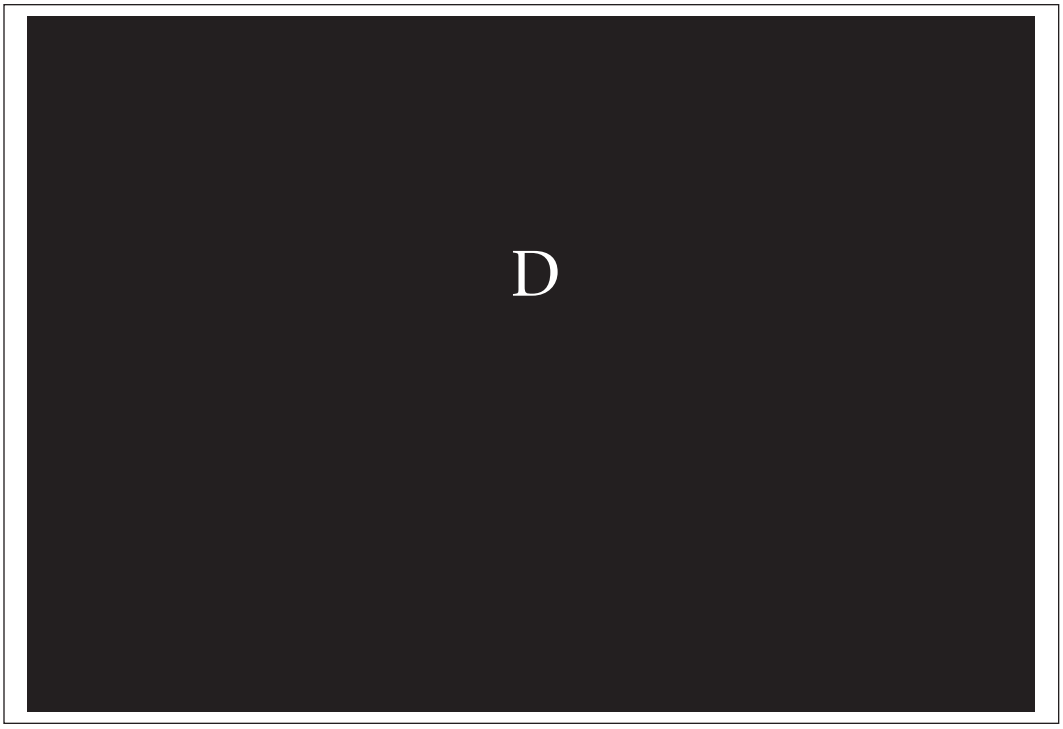
investor against realized inflation while retaining all of the real interest rate exposure inherent in any extended-maturity bond.

In fact, compared to nominal bonds of equivalent maturity, TIPS actually have more exposure to real interest rates because they have a longer "real interest rate duration." Thus, in the current environment, TIPS protect against a reversion to previous policy regimes, but paradoxically may actually increase the portfolio's exposure to inflation risk in the current environment.

Figure 2 repeats these graphs, substituting S&P 500 returns for the bond returns. The story is largely similar, although the greater volatility of stock returns somewhat clouds the picture.

What these graphs fail to show is that the relationship between changes in the rate of inflation and investment returns did not disappear. In fact, if anything, this relationship actually became stronger in the sense that the pairwise correlations in Table 1 are actually higher in the second period. (A more refined analysis below suggests that a more broadly defined notion of inflation risk is roughly constant over the two periods.)

PANEL 2: JANUARY 1983 TO MARCH 1997



Source: Department of Labor and Ibbotson Associates.

Table 1: Early and Later Period Statistics

PANEL 1: VARIANCE

	JAN 61-DEC 82	JAN 83-MAR 97
U.S. CPI	0.00119	0.00010
U.S. GOVERNMENT BONDS	0.00638	0.01227
S&P 500	0.02036	0.01530

PANEL 2: CORRELATION WITH THE U.S. CPI

	JAN 61-DEC 82	JAN 83-MAR 97
U.S. GOVERNMENT BONDS	-0.23	-0.33
S&P 500	-0.20	-0.36

The reason for this apparent contradiction with the visual impression from the graphs is that as the Federal Reserve began to respond aggressively to inflation pressure, the impact on portfolios from that inflation pressure increased, even while observable changes in the rate of inflation largely disappeared. Thus, the importance of inflation risk within the portfolio actually increased, but became real interest rate risk rather than simple "inflation risk."

GLOBAL VERSUS LOCAL INFLATION

Inflation can arise in a number of ways, but three stand out in the current context:

1) a strong global economy that generates shortages of labor, capital, and goods, forcing a general worldwide increase in prices;

2) a policy accident in which only one country inflates, usually to offset a major fiscal imbalance that is also causing the real economy to slow as well; and

3) a major supply shock such as the 1973 oil shock.

Note that the first and third are global inflations, while the second describes a local inflation. It is also worth noting that supply shocks almost

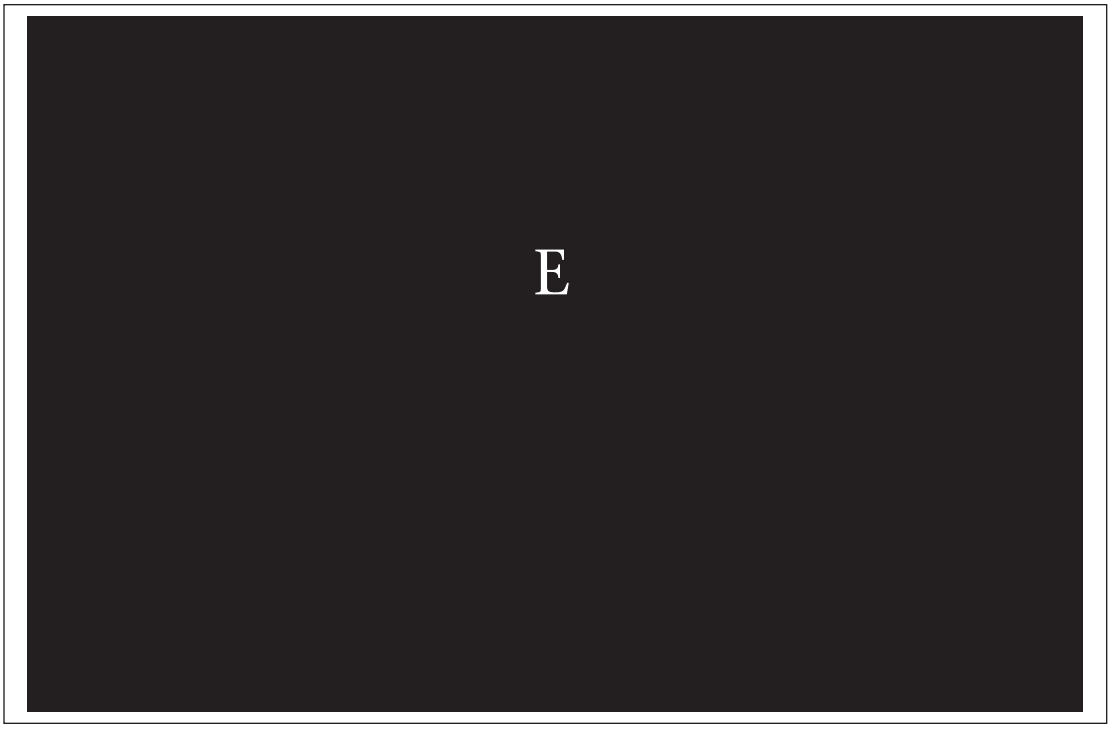
inevitably occur in periods of high global demand. In periods of lower demand, the economy is far more able to absorb the reduction in supply without a significant increase in inflationary pressures. Thus, it is not completely clear if the first and third sources of inflation really differ except in the severity of the resultant economic retrenchment.

For historical analysis, the point is that the data generally used for analyzing U.S. financial markets (back to 1970 or so) do not cover any periods in which the U.S. has had a truly local inflation.

To illustrate this, we first look (see Figure 3) at the 12-month inflation rates of the G-7 and its constituent countries over the last 36 years. Here we see both broad global trends and significant local variation. If we extended the analysis beyond the G-7, we would expect to find even more local variation as counties experienced significant currency and inflation problems due to local conditions, such as the recent peso problem in Mexico.

In contrast, if we compare just the U.S. and G-7 average inflation (see

Figure 3: G-7 and Constituent Country 12-Month CPI Inflation



Source: OECD, Department of Labor, WEFA.

Figure 4: G-7 and U.S. 12-Month CPI Inflation

Source: OECD, Department of Labor, WEFA.

Figure 4), it is hard to make any meaningful distinction between the global and U.S. inflation experiences. To the extent that this correlation simply reflects the size and diversified nature of the U.S. economy, it is likely to be a stable feature of the future.

This result also reflects the success of U.S. monetary and fiscal policy. We would note that past success does not rule out the possibility that future mistakes might trigger a local U.S.-only event. The abrupt change in the conduct of U.S. monetary policy in 1979 was partly due to warnings from foreign central banks that unless the United States became significantly more serious about fighting inflation, the banks would no longer provide support for the dollar. This would have placed the status of the dollar as a reserve currency in jeopardy, and could easily have triggered a U.S.-specific financial crisis.

Since the data contain no U.S.-only inflations, no inferences can be drawn about the probability of such an event or the impact should such an event

occur. This is a general problem when measuring the event risk associated with low probability events. Whether the event is an oil shock or a policy accident, the data tend to overstate the probability of events that have happened and understate the probability of events that have not happened.

Thus, standard correlation analysis, which is based purely on historical data, probably severely underestimates the value of international diversification in general and of unhedged foreign fixed income instruments in particular. A local inflation induces a serious real depreciation of domestic debt instruments and usually also sets off a depreciation of the domestic currency. In such an environment, unhedged foreign-denominated debt instruments tend to produce extraordinary returns in the domestic currency, as do foreign equities.

In the absence of sufficient historical data, the investor is forced to use scenario analysis to assess the subjective probabilities of various risks. In addition, it is necessary to understand how various assets will likely perform in those scenarios. Much of the rest of this article is focused on this second issue.

In the current environment, the risk of a U.S.-only, policy-induced inflation would seem reasonably small. However, as we analyze the historical performance of different assets in the next section, this lack of U.S.-only inflation events suggests that the value of the successful assets is likely to be somewhat overstated and the value of international diversification significantly understated. In particular, we need to be cautious about assets whose primary (or sole) value was in hedging the 1970s oil shocks.

ASSESSING AND ADDRESSING INFLATION RISK

A key implication of the prior discussion is that it is important to condition any empirical investigation into the relationship of asset returns to inflation on the nature of the monetary policy regime. Further, it is important to distinguish between the impact of the level of inflation and the change in the rate of inflation.

Some assets, such as bonds, which have a fixed nominal value, lose value as the general price level rises. Other assets, such as stocks, are inherently real assets and are primarily impacted by changes in the cyclical environment. For such assets, the main inflation risk is that of rising inflation, which suggests

higher real rates, lower earnings growth, and a higher probability of recession. The level of inflation has less impact on these assets.

For our work, we take a simple approach. We run a multiple regression relating the 12-month returns on assets to the contemporaneous 12-month CPI inflation rate and the change in that inflation rate over the prior 12-month period. We run the regression for two periods: January 1961 to December 1982 and January 1983 to March 1997.[3]

Table 2: 12-Month Return Regressions on U.S. CPI Inflation

			12-Month U.S. CPI Inflation Rate					
			12-Month Change in		Level of			
	R-Squared		Coefficient (t-statistic)(b)		Coefficient (t-statistic)(b)		Return Volatility Due to Inflation	
Dependent Variable	Jan 61 to Dec 82(a)	Jan 83 to Mar 97	Jan 61 to Dec 82(a)	Jan 83 to Mar 97	Jan 61 to Dec 82(a)	Jan 83 to Mar 97	Jan 61 to Dec 82(a)	Jan 83 to Mar 97
60/40 Portfolio	0.317	0.321	-2.313 (-3.24)	-3.710 (-3.70)	-0.301 (-0.58)	-1.186 (-0.62)	5.43%	5.99%
S&P 500	0.184	0.227	-2.610 (-2.07)	-3.366 (-2.11)	-0.375 (-0.39)	-1.785 (-0.78)	6.13%	5.89%
U.S. Government Bonds	0.290	0.309	-1.868 (-2.67)	-4.227 (-5.24)	-0.189 (-0.46)	-0.289 (-0.16)	4.30%	6.16%
Small-Cap Stocks	0.111	0.494	-3.744 (-1.97)	-6.379 (-2.98)	0.351 (0.32)	-4.648 (-1.40)	7.74%	12.27%
G-9 Equities (Local-Currency Basis)	0.206	0.221	-2.786 (-2.03)	-1.870 (-0.93)	1.921 (1.61)	-5.508 (-1.40)	6.44%	7.17%
3 Month T-Bills	0.750	0.372	-0.477 (-1.68)	-0.631 (-2.73)	0.775 (6.67)	1.405 (3.32)	2.58%	1.17%
GSCI Total Return	0.551	0.331	6.497 (6.49)	1.996 (1.31)	-2.454 (-2.07)	6.085 (2.01)	16.19%	7.91%
Physical Gold	0.523	0.104	8.993 (6.19)	0.639 (0.20)	-0.114 (-0.04)	-4.627 (-1.59)	23.80%	4.01%
NCREIF (Appraisal) Real Estate	0.906	0.014	0.177 (3.17)	0.675 (0.61)	0.765 (9.51)	-0.222 (-0.17)	2.45%	0.64%
NAREIT Real Estate	0.070	0.364	-1.715 (-1.13)	-3.927 (-2.98)	0.386 (0.20)	-2.986 (-0.96)	4.39%	7.60%

(a) January 1961 is the earliest time for which we have 12-month changes in the 12-month U.S. CPI inflation rate. Not all asset return series begin in January 1961. The first month of the 12-month return series for the G-9 equities is February 1974; for the GSCI, December 1970; for gold, January 1969; for NCREIF real estate, December 1972; and for NAREIT real estate, December 1978.

(b) The t-statistics are based on robust standard errors, allowing for heteroskedasticity according to White (1980).

From an inflation-hedging standpoint, what we are looking for are assets that have strong relationships to inflation but that respond to inflation opposite to the way the fund portfolio to be hedged responds. To define a benchmark portfolio, we start with a balanced equity and bond portfolio, in particular, a 60% U.S. equity (S&P 500) — 40% U.S. government bond portfolio.

Thus, the first regression in Table 2 shows the relationship of the 60/40 portfolio returns to U.S. CPI inflation, with the other assets following. For the standard portfolio, only the change in the rate of inflation has a significant impact on the returns, with a coefficient of -2.31 in the early period (January 1961 to December 1982) and -3.71 in the later period (January 1983 to March 1997). The coefficients for the level of inflation, while not statistically significant, are -0.30 and -1.19, respectively.

This means that, in the early period, a change in the inflation rate from 3% to 4% would have decreased expected portfolio returns by 231 basis points based on the 12-month change, and by a further 30 basis points based on the new level of inflation, for a total reduction of 261 basis points in the expected portfolio return. In the later period, the losses for the change and the new level are 371 basis points and 119 basis points, respectively, for a total reduction of 490 basis points in the expected return.

As we expected from the prior graphical analysis, a given change in observed inflation has greater impact on the portfolio returns in the later period than in the pre-Volcker period. This is particularly true when we think of the response over more than one period. That is, the asset response to the change in the rate of inflation is a one-time impact. However, in the absence of further change in the rate of inflation, the "new" level of inflation would be expected to continue to impact the asset returns over the ensuing periods. In our 60/40 portfolio example, that would mean a continued loss of 30 basis points of return in the pre-Volcker period and of 119 basis points in the current period.

For the standard portfolio, the inflationary pressures account for about 32% of the variance in the portfolio returns in both periods (i.e., the R-squared is 0.317 in the early period and 0.321 in the later period). For the equities (S&P 500, small-cap stocks, and G-9 equities), U.S. government bonds, and REITs (represented by the NAREIT Real Estate Index), we see a similar pattern of equal to higher explanatory power in the later period,

with the increase most dramatic for small-cap stocks (11% to 49%) and REITs (7% to 36%).[4]

Looking at the absolute amount of inflation-related risk in the portfolio, the last two columns of Table 2 show the 12-month volatility of returns induced by shifts in inflation according to the regression models. Here we see that the impact of inflation on the 60/40 portfolio returns is roughly constant over the two periods: in the early period, inflationary pressures generate 5.43 percentage points of return volatility; in the later period, inflation generates 5.99 percentage points of return volatility. With a few exceptions, individual assets show similar patterns, with roughly constant inflation risk across the two periods.

What this means is that despite the apparent absence of inflation volatility over the last 14 years, the actual risk faced by investors in terms of related portfolio volatility has remained the same or, in many cases, increased.

For T-Bills, commodities (represented by the Goldman Sachs Commodity Index or GSCI®[5]), physical gold, and NCREIF real estate (an appraisal-based real estate index), the explanatory power decreases in the later period, although it remains significant for both cash and commodities (37% and 33%, respectively). Note that the extreme drop in the explanatory power for NCREIF returns reflects the inflated explanatory power of the early period; since NCREIF data is only available from January 1978 on, the early period is quite short and its early period estimates may be significantly overfit.

The result is that for hedging the inflation risk of the standard 60/40 portfolio, we want an asset that has a large positive coefficient on the change in the rate of inflation and for which inflation provides significant explanatory power. Since the results for the other equities are broadly similar, a hedging strategy developed for the 60/40 portfolio would still be appropriate for a more equity-dominated fund portfolio.

Even though U.S. and G-7 CPI inflation have been quite similar, as we saw in Figure 4 above, there is enough difference to impact these regression results, which are repeated for G-7 inflation in Table 3, at right. From this more international perspective, the results are broadly similar, with explanatory power and sensitivity to changes in inflation generally increasing in the later period for the stocks and bonds.

We would note that domestic assets (the 60/40 portfolio and its

Table 3: 12-Month Return Regressions on G-7 CPI Inflation

			12-Month G-7 CPI Inflation Rate					
			12-Month Change in		Level of			
	R-Squared		Coefficient (t-statistic)(b)		Coefficient (t-statistic)(b)		Return Volatility Due to Inflation	
Dependent Variable	Jan 62 to Dec 82(a)	Jan 83 to Mar 97	Jan 62 to Dec 82(a)	Jan 83 to Mar 97	Jan 62 to Dec 82(a)	Jan 83 to Mar 97	Jan 62 to Dec 82(a)	Jan 83 to Mar 97
60/40 Portfolio	0.266	0.253	-2.300 (-3.45)	-4.907 (-4.06)	-0.151 (-0.32)	0.135 (0.08)	4.97%	5.32%
S&P 500	0.170	0.165	-2.645 (-2.23)	-4.641 (-2.61)	-0.336 (-0.36)	-0.171 (-0.08)	5.89%	5.03%
U.S. Government Bonds	0.199	0.265	-1.782 (-2.78)	-5.306 (-3.84)	0.127 (0.30)	0.594 (0.35)	3.56%	5.70%
Small-Cap Stocks	0.172	0.385	-4.875 (-2.99)	-9.523 (-2.95)	0.416 (0.34)	-1.420 (-0.44)	9.66%	10.84%
G-9 Equities (Local-Currency Basis)	0.218	0.167	-2.566 (-2.02)	-5.191 (-2.21)	0.386 (0.16)	-1.930 (-0.61)	6.63%	6.24%
3 Month T-Bills	0.548	0.572	-0.347 (-0.98)	-0.369 (-1.78)	0.697 (3.52)	1.422 (4.54)	2.20%	1.45%
GSCI Total Return	0.549	0.320	6.846 (6.18)	5.964 (3.83)	-3.061 (-3.10)	3.124 (1.05)	16.16%	7.78%
Physical Gold	0.529	0.123	9.570 (5.03)	-1.502 (-0.48)	-0.189 (-0.07)	-3.721 (-1.53)	23.92%	4.35%
NCREIF (Appraisal) Real Estate	0.905	0.007	0.456 (5.95)	0.284 (0.27)	0.749 (5.11)	0.589 (0.43)	2.45%	0.45%
NAREIT Real Estate	0.140	0.382	-1.655 (-1.06)	-7.140 (-5.76)	-1.107 (-0.47)	0.236 (0.09)	6.19%	7.79%

(a) January 1962 is the earliest time for which we have 12-month changes in the 12-month G-7 CPI inflation rate. Not all asset return series begin in January 1962. The first month of the 12-month return series for the G-9 equities is February 1974; for the GSCI, December 1970; for gold, January 1969; for NCREIF real estate, December 1972; and for NAREIT real estate, December 1978.

(b) The t-statistics are based on robust standard errors, allowing for heteroskedasticity according to White (1980).

constituents, the S&P 500 and government bonds, as well as small-cap stocks, U.S. T-Bills, and NCREIF real estate) have a somewhat stronger relationship to U.S. CPI inflation than G-7 inflation, while there is less difference for other assets.

With respect to G-7 inflation, the key distinction for the standard portfolio and S&P 500 remains the change in the rate of inflation, with the increase in sensitivities between the early and later periods somewhat more pronounced. Further, G-9 equities, our best proxy for a global local-currency equity portfolio, show a similar pattern of results; small-cap stocks have the same qualitative pattern, although the sensitivities are more extreme.

Of the assets we examined, only commodities offer the opposite pattern of sensitivities. They show significant positive coefficients to the change in G-7 inflation, 6.8 and 6.0 in the early and later periods, respectively. This suggests that commodities have significant potential as an effective inflation-hedge for an equity-dominated fund portfolio. However, the instability of the relationship between commodity returns and the level of inflation makes commodities a poor protector if the asset being protected is a real income stream rather than the return-generating equity-dominated portfolio we have been explaining.[6]

Because of its low volatility, cash offers some hope in hedging the standard portfolio. But it is unlikely to have much impact on the overall portfolio performance at the modest levels of usual cash allocations. However, with its significantly positive sensitivity to the level of inflation (although small in absolute magnitude), cash could provide some protection against high as opposed to rising inflation.

Of the assets we examined, only commodities and, to a lesser extent, cash provided significant protection against the inflation risk inherent in the standard portfolio.

The remaining so-called inflation-hedging assets, gold and real estate, do not do as well. Physical gold only helped significantly in the earlier period. NCREIF real estate, which is appraisal-based, would have helped in the earlier period had it been transactionable. However, even then the sensitivity was low, implying a need for a significant weighting in a portfolio to provide significant inflation risk hedging. Further, the explanatory power of inflation virtually disappears in the later period.

REITs, which are a transactionable form of real estate, had much the same response to inflation that the core equity/bond portfolio did, making them a poor choice for hedging this type of portfolio. We would note, however, that

if our goal had been to hedge real income generation, REITs would have been more valuable.[7]

Of the assets we examined, only commodities and, to a lesser extent, cash provided significant protection against the inflation risk inherent in the standard 60/40 portfolio or an equity-dominated fund portfolio.

SUMMARY OF INVESTMENT POLICY ISSUES

The proactive anti-inflationary monetary policies that have been followed since the 1970s have not diminished inflation risk to equity and bond portfolios. Rather, those policies have changed the form of that risk from the risk of high observed rates of inflation to the risk of real interest rate volatility that arises as monetary authorities seek to prevent inflation from becoming realized. The risk is now much more one of cyclical performance and less one of continuing devaluation of nominal assets.

In the context of an equity-dominated balanced fund portfolio, we would suggest that the key inflation risks need to be divided broadly between two classes of inflation:

- Local policy-generated inflation, characterized by local economic distress, currency problems, and a local inflation considerably higher than the international average; and
- Common global inflation generated by strong global economies.

Risk of local inflation can generally be well hedged by international diversification on an unhedged currency basis, but such diversification is not an effective hedge against the risk of global inflation. Nor are most so-called inflation-hedging assets (TIPS, gold, real estate), as these assets have considerable exposure to the rising real interest rates that tend to characterize rising inflation environments, especially when monetary policy is pro-actively anti-inflationary.

We would suggest that cash and commodities, both inherently near-term assets, hedge global inflations better. In particular, commodities have generated considerable returns in high output global economies.

The exception occurs when a local inflation and the policy mistake driving it become more general. An example of this scenario is 1973–1975, when

central banks attempted to inflate their way out of the consequences of the 1973 oil shock. Such generalized policy errors can only be hedged through the use of inflation-linked securities, cash, gold, or, in the case of commodity shocks, commodities.

We would note, however, that local U.S. policy problems are likely to have significant ramifications beyond U.S. borders and could easily generate significant problems in foreign equity markets. Thus, we would consider supplementing unhedged international equity diversification with unhedged international bonds to help address this aspect of inflation risk.

We also would not rule out the usefulness of inflation-linked bonds if the expected real returns were sufficient. However, we would emphasize that TIPS, which are helpful in the presence of realized inflation, are primarily useful for hedging the risk of poor or inflationary monetary policy and not the much more general risks engendered by inflationary pressures.

On an historical basis, commodities provide very strong inflation protection for an equity-dominated fund portfolio. The main inflationary risk to such portfolios is the one that has been experienced over the historical sample: strong global economies.

The observed effectiveness of diversified commodity investments in the presence of strong pro-active anti-inflationary monetary policy during the 1980s and more recently is reassuring. Nevertheless, we would caution that if global growth became centered in commodity-efficient sectors or regions of the global economy, then commodities could well disappoint. Further we would note that commodities are actually quite poor at mitigating the risks of continuing high inflation or non-commodity-generated stagflations. However, as there are no close substitutes for dealing with the risk of global economic strength beyond tactical allocations to cash, commodities are likely to prove a highly useful component of a well-designed inflation-hedging program.

The most serious caveat to the entire analysis is that, for an equity-based fund portfolio, the overall inflation risk is fairly moderate and mostly a matter of the stability of returns over time, as equities are real assets. In this context, we would suggest that inflation hedging programs should not be aggressively pursued in ways that would be expected to significantly degrade long-run returns.

We would also note that the analysis would be quite different if we had

examined the risk to income flows.[8] Pure income portfolios (e.g., the portfolio for a retiree living on the income and wishing to preserve a constant real income level) tend to be dominated by nominal bonds rather than by equities. Thus, they have substantial pure inflation risk in that high levels of inflation cause the real income flow to decline over time. Inflation-linked bonds can have substantial advantages in this type of portfolio, while international diversification and commodities would likely add unwanted volatility.

We would re-emphasize that the conduct of monetary policy is central to the size and nature of inflation risk. Thus, inflation risk is inherently unstable over time as policy regimes evolve, and inflation-hedging programs require a dynamic aspect that reflects the current political and policy environments.

APPENDIX A: DATA DESCRIPTION

The returns used in this paper are all 12-month continuously compounded total returns sampled monthly. The S&P 500, U.S. government bond, and small-cap stock series are from Ibbotson Associates. The G-9 equity series is a capitalization-weighted average of individual-country local-currency total return indices. Over the period for which they exist (1986 on), the FT-A/S&P equity indices are used for the G-9 countries: the United States, the United Kingdom, Japan, Germany, France, Italy, Canada, The Netherlands, and Switzerland. In order to extend the sample further back, Datastream country equity indices for 1973 through 1985 are spliced with the FT-A/S&P indices.

The GSCI data is from Goldman, Sachs & Co. The real estate data series are the NCREIF quarterly assessment index, linearly interpolated to make a monthly index, and the NAREIT total return index. The physical gold series is the London p.m. fix.

The U.S. CPI data are from the Department of Labor. The G-7 and its other constituent country CPIs are from the OECD. All CPI data are provided through WEFA, as is the three month T-Bill rate.

NOTES

1. TIPS can be highly useful in a number of other contexts as discussed i*n Treasury Inflation-Protection Securities: A Useful Tool, But Not a Cure-all,* Goldman, Sachs & Co., Dudley, Macirowski, Richman, Strongin, and Youngdahl, October 1996; and the April 1997 Goldman, Sachs & Co. *Pension & Endowment Forum,* "Managing the Inflationary Exposure of Traditional Portfolios: Treasury Inflation Protection Securities and Their Alternatives," Dudley, Strongin, Kostin, and Taylor.

2. "The Identification of Monetary Policy Disturbances: Explaining the Liquidity Puzzle," Steve Strongin, *Journal of Monetary Economics*, 35, 1995, and "Measuring Monetary Policy," Bernanke and Mihov, *NBER Working Paper 5145*, June 1995.

3. We use 12-month periods to allow sufficient time for assets to respond to the underlying economics and for trading noise to smooth out of the data. We think this better corresponds to the risk investors actually care about. We deal with the overlapping observations by adjusting the standard errors and hence the t-statistics for the induced serial correlations in the regression residuals. We also adjust the standard errors for the changing volatility of returns over time, i.e., heteroskedasticity. See "A Heteroskedasticity-Constant Covariance Matrix Estimator and Direct Test for Heteroskedasticity," Halbert White, *Econometrica,* Vol. 48, 1980.

4. We would note that the R-squared results are fairly sensitive to the treatment of the transition period from 1979 to 1982. However, the broader result that the explanatory power is similar, but that the sensitivity to the change in the rate of inflation increases substantially, is quite robust.

5. GSCI® is a registered mark of Goldman, Sachs & Co. The GSCI total return index represents the returns to a passive, long-only, diversified portfolio of commodity futures.

6. It is also worth noting that the relationship to purely U.S. inflation, while large in an absolute sense, is not statistically well estimated. This reflects the global nature of the commodity markets and the lack of clear connection to inflation in any one country.

7. Again see the Goldman, Sachs & Co. April 1997 *Pension & Endowment Forum.*

8. Again, see *Treasury Inflation-Protection Securities: A Useful Tool, But Not a Cure-all* and the April 1997 Goldman, Sachs & Co. *Pension & Endowment Forum.*