Inflation Hedging Through International Equity Investment

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Abstract

For years common stocks were thought to be an effective inflation hedge. The dismal performance of domestic equities in the 1970's was, thus, completely unanticipated. A possible method for improving stock portfolio performance on a period-by-period basis vs. inflation would be the inclusion of foreign equities. Regression analysis of various foreign equity markets and internationally efficient portfolios vs. measures of actual, expected and unexpected inflation indicated that including non-US equities in portfolios did not protect investors from inflation on a period-by-period basis in the 1970-88 time period.

Introduction

A major objective of any investor is to increase their real net worth over time. This implies that their selected investments must have not only a positive nominal return over time but must also grow in excess of the rate of inflation. Unfortunately, this objective is easier stated than realized. The devastating impact of inflation on financial asset returns has been well documented. In general, the evidence suggests that both stocks and bonds behave as perverse, or negative, hedges against unexpected inflation on a period by period basis. While it easy to see why bonds would be a poor investment in periods of rising inflation the exasperating occurrence in the 1970's was the failure of stocks to serve as an effective inflation hedge over shorter periods of time.

One possible method of dealing with the unfavorable performance of domestic stocks during periods of inflation would be the inclusion of foreign equities in an investor's portfolio. The potential benefit of international equity investments as a way of reducing portfolio risks and boosting returns over time has long been recognized due to the less than perfect correlation between the US and foreign economies. This, however, does not imply that an internationally diversified portfolio would automatically serve as an effective period-by-period inflation hedge. For this to occur, the foreign investments would have to be hedges against US inflation. In this paper, we examine the inflation hedging effectiveness of both selected foreign equity markets and mean-variance efficient portfolios of domestic and international stocks.

Previous Literature

The literature on international diversification benefits is long and well developed. Levy and Sarnat (1970), Solnik (1974), Khoury and Gosh (1984), Shaked (1985), and Eun and Resnick (1985, 1987) examined the potential benefits of including foreign equities in a domestic portfolio. Solnik analyzed eight European stock markets and a group of US stocks during the 1966-71 period. Using both hedged and unhedged portfolios he concluded that the addition of international stocks reduced portfolio risk. These findings have been supported by the above researchers (as well as others) and there is little doubt about the desirability of international equity diversification.

As stated earlier, a matter related to the above topic is the potential use of international stocks to guard against the effects of unanticipated inflation on US equities. Numerous studies document the above perverse effects of inflation on stock returns for the US. These include Nelson (1976), Jaffe and Mandelker (1976), Fama and Schwert (1977), and Stulz (1986). These studies concluded that the unexpected component of inflation (recall that actual= expected plus unexpected) was the principal cause of the perverse hedging aspect of common shares.

Gultekin (1983) also concluded that most nations exhibited a negative relationship between stock returns and their domestic inflation rates. The expected rate of inflation in the nations studied by Gultekin was derived from two sources. One was an ARIMA model of past rates of inflation and the other was the use of short-term government yields as a proxy for expected inflation. This study did not attempt to observe returns from the point of view of US investors (that is, all returns were in foreign currency units). Solnik (1983) studied the relationship between inflation and stock prices in nine countries. His measure of expected inflation was the monthly deposit rate on Eurodollars. While finding a negative relationship in all nine cases, the results were not adjusted for exchange rate differences and were, thus, of little use to US investors.

While it is obvious from this literature review that researchers have examined the relationship between stock returns and inflation for many countries, the specific hedging effectiveness of foreign stocks against US inflation does not appear to have been explored. It has been demonstrated theoretically and empirically that international diversification allows for the improvement of the risk-return trade-off for equities due to less than one- for-one correlations between various country stocks. It seems reasonable, then, that foreign stocks might exhibit less negative tendencies towards US inflation for the same reason. This question will be empirically examined in the next section.

Empirical Tests

In order to test the relationship between foreign stock returns and US inflation we use time series linear regression estimates with the appropriate foreign market return as the dependent variable and either actual, expected or unexpected US inflation as the independent variable. In addition, optimal portfolios will be calculated over the period in question and those will also be tested as hedges against US inflation. A particular stock market or portfolio is defined as a complete positive hedge against inflation if the slope of the regression in question is greater than or equal to one. It is defined as a complete negative hedge if the slope is less than or equal to negative one. A partial hedge is defined as a regression where the slope is not different from zero. Of course, given the size of the standard error of the regressor, it is possible (but not likely) that a particular market or portfolio may fit more than one of the above definitions.

Foreign equity returns (capital gains and dividends) are from *Morgan-Stanley Capital International*. The returns are adjusted for changes in US exchange rates and, thus, are expressed in US dollars. The data is used to generate annual holding period yields using June to June and December to December data from 1970 through June of 1988. The time periods selected correspond with the various measures of inflation used in the study. The expected US inflation variable is the *Livingston Price Expectation Data,* a semiannual survey conducted by the Federal Reserve Bank of Philadelphia. It measures the mean value of the participants' estimate of the change in the consumer price index over the next year. The merits of this approach in measuring expected inflation have been well developed in studies by Menil and Bhalla (1975), Carlson and Parkin (1975), Carlson (1977) and Mullineaux (1980).

The actual rate of inflation over the period in question is the percentage change in the consumer price index over each 12 month sample in question. The CPI is from the *Department of Labor's Monthly Business Review.* The unexpected rate of inflation is thus equal to the actual rate minus the expected rate for that period. From Fama and Schwert, all variables in the study are expressed as the nat-

ural log of 1 plus the relevant percentage expressed as a fraction (this is equivalent to the natural log of the ratios of the index in question).

The results of the regressions are expressed in Tables 1 through 3 where actual, expected and unexpected inflation are used as the regressor onto the various foreign stock returns. Given that autocorrelation of the regression residuals is always suspect in time series estimates, the correction technique devised by Newey and West (1987) is utilized in all runs. This method has several advantages over such earlier techniques as the Cochrane-Orcutt method, including consistent estimates of the covariance matrix.

The regression results are striking. Table-1 shows the relationship between holding period yields for various foreign equity markets and actual US inflation over the period examined. As expected, the US market performs in a highly perverse manner against realized US inflation (slope= -2.427). This is in assent with numerous earlier studies on inflation and the US equity market. The strange observation, however, is the relationship between foreign stocks and US inflation. Note that in Table 1 only two countries, Mexico and Norway, exhibit a positive relationship with actual US inflation. These coefficients, however, are highly insignificant (t-statistics of .287 and .138, respectively). The relatively low explanatory power of the regressions (R^2) is to be expected because ex-ante real returns are treated as a constant. Since we seek only to examine hedging effectiveness the coefficient of determination does not hold its normal importance in testing the hypothesis (Ang, 1983).

A further impressive finding is that holding a portfolio of international stocks does not eliminate the ravages of US inflation on equity returns. Regressions of returns for European markets, Europe and the Far East and the World all show highly negative, statistically significant relationships with actual US inflation.

Table 2 presents the relationship between realized stock returns and expected US inflation. Total US stock returns over this period were a complete hedge against expected inflation, but the coefficient is insignificant. While six of the individual foreign markets exhibit a positive relationship with US expected inflation, they are also insignificant. This is also the case with the remaining foreign stock markets and combined indices. Thus, all measures in question are defined as partial hedges against expected inflation.

Table 3 lists the results of stock returns and unexpected inflation. In the US, as expected, common stocks exhibit a highly perverse relationship with unexpected increases in inflation (slope= -3.676). With regard to foreign stock returns, only Austria, Mexico and Norway have a positive slope and Austria's is only slightly greater than zero. In addition, Mexico and Norway's slopes are

TABLE I
Independent Variable - Actual US Inflation

MARKET	CONSTANT	SLOPE	R2
US	.235 (2.89)	-2.427 (1.976)	.269
AUSTRALIA	.154 (1.00)	-.930 (.423)	.368
AUSTRIA	.180 (1.18)	-1.249 (.577)	.410
BELGIUM	.434 (3.66)	-4.896 (2.774)	.502
CANADA	.170 (1.41)	-1.234 (.669)	.183
DENMARK	.320 (2.52)	-3.239 (1.664)	.260
FRANCE	.325 (1.95)	-3.640 (1.503)	.385
GERMANY	.271 (2.26)	-2.543 (1.443)	.371
HONG KONG	.263 (1.07)	1.915 (.533)	.311
ITALY	.281 (1.20)	-3.807 (1.284)	.538
JAPAN	.558 (4.74)	-5.696 (3.267)	.531
MEXICO	-.029 (.075)	1.610 (.280)	.308
NETHERLANDS	.328 (3.01)	-3.136 (2.257)	.398
NORWAY	.084 (.388)	.450 (.138)	.223
SINGAPORE	.417 (1.64)	-4.763 (1.287)	.309
SPAIN	.209 (1.36)	-2.260 (1.230)	.640
SWEDEN	.347 (2.87)	-3.105 (1.712)	.293
SWITZERLAND	.314 (2.79)	-3.361 (2.033)	.405
U. K.	.326 (2.26)	-3.332 (1.539)	.260
EUROPE	.303 (2.88)	-3.089 (2.011)	.418
EUROPE, EAST	.392 (3.90)	-3.965 (2.767)	.548
WORLD	.306 (3.78)	-3.092 (2.572)	.411

TABLE 2
Independent Variable - Expected US Inflation

MARKET	CONSTANT	SLOPE	R2
US	.030 (.207)	1.189 (.481)	.186
AUSTRALIA	.195 (.825)	-1.662 (.425)	.368
AUSTRIA	.416 (1.94)	-5.461 (1.522)	.434
BELGIUM	.524 (2.56)	-6.589 (1.893)	.447
CANAOA	.218 (1.21)	-2.086 (.687)	.182
DENMARK	.237 (1.09)	-1.718 (.467)	.201
FRANCE	.299 (1.10)	-3.224 (.711)	.351
GERMANY	.248 (1.19)	-2.164 (.620)	.341
HONG KONG	-.039 (.095)	3.417 (.505)	.310
ITALY	-.066 (.189)	2.396 (.436)	.516
JAPAN	.441 (2.04)	-3.672 (1.007)	.385
MEXICO	.899 (1.71)	-14.900 (1.692)	.365
NETHERLANDS	.266 (1.52)	-2.076 (.707)	.319
NORWAY	.558 (1.82)	-8.002 (1.549)	.275
SINGAPORE	.047 (.130)	1.815 (.303)	.315
SPAIN	.057 (.186)	1.532 (.342)	.630
SWEDEN	.161 (.785)	.070 (.049)	.229
SWITZERLAND	.297 (1.53)	-3.107 (.952)	.348
U. K.	.032 (.123)	1.868 (.430)	.211
EUROPE	.183 (.931)	-.977 (.298)	.349
EUROPE, EAST	.217 (1.14)	-.858 (.270)	.350
WORLD	.144 (.918)	-.241 (.091)	.292

insignificant (t-statistics of .235 and .917). The broader measures of foreign stock returns for Europe, Europe and the Far East and the World all behaved in a perverse, statistically significant manner with regard to US unexpected inflation.

Although the above results are of value to specialized institutional investors most individual investors include foreign equities as only a portion of their portfolios. We dealt with this mixed-asset portfolio consideration by cre-

ating four mean/variance efficient portfolios which include the foreign equity markets of Australia, Canada, the Far East and Europe. Using a Markowitz variance/covariance model we determined the efficient frontier and selected the portfolio with the highest Sharpe's Index measure. The returns from these portfolios (expressed as the natural log of 1 plus their return) were then regressed against our actual, expected and unexpected measures of inflation. The results are shown in Tables 4 thru 6. Note that the efficient portfolios all behave as a negative hedge against

TABLE 3
Independent Variable - Unexpected US Inflation

MARKET	CONSTANT	SLOPE	R2
US	.100 (2.70)	-3.676 (2.897)	.347
AUSTRALIA	.102 (1.15)	-.405 (.179)	.365
AUSTRIA	.110 (1.12)	.245 (.105)	.402
BELGIUM	.155 (1.75)	-3.598 (1.574)	.446
CANADA	.101 (1.65)	-.820 (.398)	.175
DENMARK	.143 (2.11)	-3.348 (1.482)	.249
FRANCE	.117 (1.12)	-3.241 (1.189)	.371
GERMANY	.126 (1.71)	2.426 (1.23)	.363
HONG KONG	.152 (1.07)	3.611 (.938)	.323
ITALY	.059 (.355)	-4.176 (1.462)	.544
JAPAN	.236 (2.75)	-6.090 (2.853)	.511
MEXICO	-.059 (.296)	7.003 (1.235)	.341
NETHERLANDS	.150 (2.74)	-3.043 (1.879)	.379
NORWAY	.109 (.986)	3.285 (.917)	.245
SINGAPORE	.142 (.909)	-6.500 (1.712)	.373
SPAIN	.131 (.778)	-2.401 (1.125)	.644
SWEDEN	.172 (2.74)	-3.994 (2.00)	.315
SWITZERLAND	.122 (1.64)	-3.172 (1.635)	.386
U. K.	.139 (1.94)	-5.005 (2.152)	.306
EUROPE	.127 (1.91)	-3.437 (2.007)	.423
EUROPE, EAST	.166 (2.28)	4.394 (2.818)	.557
WORLD	.131 (2.78)	-3.901 (2.904)	.443

actual US inflation (Table 4). It is obvious from these results that the diversification benefits of international investment did not significantly improve the inflation hedging effectiveness of US investors.

Some authors have suggested that since expected and unexpected inflation are the components of the actual inflation rate, they both should be included as regressors against the asset return variable. This was done for all of the above dependent variables. The results in terms of the significance and impact of the expected and unexpected

TABLE-4 INDEPENDENT VARIABLE IS ACTUAL US INFLATION DEPENDENT VARIABLES ARE MEAN VARIANCE EFFICIENT PORTFOLIOS- (Portfolio 1 includes US [87.5%] and Australian [12.5%] stocks, Portfolio 2 includes US [46.9%] and Canadian [53.1%] stocks, Portfolio 3 includes US [1.0%] and the Far Eastern [99.0%] stocks, Portfolio 4 includes US [9.5%] and all European [90.5%] stocks)

MARKET	CONSTANT	SLOPE	R2
PORTFOLIO #1	.020 (1.54)	-2.53 (3.32)	.037
PORTFOLIO #2	.019 (.977)	-2.27 (2.87)	.026
PORTFOLIO #3	.026 (.655)	-3.08 (2.35)	.064
PORTFOLIO #4	.034 (.035)	-3.43 (3.34)	.067

TABLE-5 INDEPENDENT VARIABLE IS EXPECTED US INFLATION DEPENDENT VARIABLES ARE MEAN VARIANCE EFFICIENT PORTFOLIOS

MARKET	CONSTANT	SLOPE	R2
PORTFOLIO #1	.0005 (.112)	.322 (1.87)	.007
PORTFOLIO #2	.011 (.566)	-.523 (1.56)	.035
PORTFOLIO #3	.012 (.455)	-.273 (2.22)	.014
PORTFOLIO #4	.038 (1.34)	-3.33 (1.77)	.043

TABLE-6 INDEPENDENT VARIABLE IS UNEXPECTED US INFLATION DEPENDENT VARIABLES ARE MEAN VARIANCE EFFICIENT PORTFOLIOS

MARKET	CONSTANT	SLOPE	R2
PORTFOLIO #1	.046 (.988)	-2.26 (2.88)	.036
PORTFOLIO #2	.057 (.555)	-1.73 (2.40)	.019
PORTFOLIO #3	.073 (.767)	-2.55 (3.19)	.054
PORTFOLIO #4	.014 (.444)	-1.70 (2.55)	.041

inflation variables were not markedly different from these variables by themselves and thus are not reported.

The above results suggest that the inclusion of foreign equities in a US based portfolio are not likely to offset the negative effects of actual and unexpected inflation on US stock returns. While there are most certainly benefits to be derived from international diversification in terms of higher returns and lower variability, it is apparent that even the holding of a world wide portfolio {at least through the 1970-1988 period} of equities does not protect investors from the harmful effects of price inflation on a period by period basis.

Summary and Conclusions

The benefits of international diversification have been known for some time. The recognition of modern portfolio theory that combining assets with less than a one-for-one correlation in their returns over time reduces risk at no cost to investors is highly obvious in terms of international diversification. An offshoot of these findings is that, given the propensity of foreign economies and stocks to move in a different manner than the US economy, US investors might be able to overcome the negative effects of US inflation on financial assets by investing overseas.

Based on the above, total return data in US dollars for 21 individual and combined foreign stock markets were

related to actual, expected and unexpected rates of US inflation. The results indicated that the vast majority of foreign equity markets in the 1970-88 sample period were perverse hedges against US actual inflation, as was the US equity market. Further results indicated that, as with the US stock market, the perverse behavior of foreign equities was because of the unexpected component of US inflation. The findings suggest that even international diversification could not be expected to eliminate the negative effects of US inflation on US based equity investments. ✻

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