Inflation and World Equity Selection

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Although much has been written about inflation and stock returns in the United States and the United Kingdom, little is known about the impact of inflation on a broader menu of countries. Consistent with previous research examining time series of inflation and stock returns in the United States, this study of inflation in 41 developed and emerging equity markets documents a significant negative relation for most countries. Cross-sectional analysis, however, indicates that inflation, as a country attribute, commands a positive premium. This finding suggests that inflation reveals information about risk exposure. Supporting the risk interpretation, the correlation between a country's inflation rate and the OECD rate of inflation is positively related to the country's equity return correlation with world market returns. Further, equity volatility is positively linked to average inflation rates. More than 50 percent of the cross-sectional variation in average inflation rates can be accounted for by country credit risk ratings.

Expected inflation plays a prominent role in global portfolio selection. In summarizing either future economic health or investment risk, investors often refer to the inflationary environment. Although extensive research has been conducted on the relation between expected inflation and asset returns in the United States and the United Kingdom, relatively little is known about how inflation interacts with expected returns in a broader group of countries.

We investigated the link between inflation, expected asset returns, and risk in a sample of 41 developing and emerging countries. We confirmed the findings of Fama and Schwert, Fama, Gultekin, and Lee that within a particular country, the relation between monthly inflation and asset returns is negative.[1] We also investigated the relation between long-term inflation and long-horizon asset returns. In contrast to the recent evidence of Boudoukh and Richardson, we did not find a positive relation between long-term inflation and long-term average asset returns.[2] This finding suggests that international equity returns fail to serve as an inflation hedge, even if the equities are held over long horizons.

Next, we examined the cross-sectional relation between inflation and asset returns. Ferson and Harvey found that asset exposure with respect to world inflation helped to explain both the cross-section and time series of expected returns in 18 developed markets.[3] We extended this analysis to emerging equity markets, in which the variation in rates of inflation is much larger than in developed markets. We found that inflation exposure, proxied either by the level of inflation in a particular country or by the correlation of local inflation to world inflation, helps explain the cross-sectional variation in expected returns. Inflation exposure also helps explain differences in volatility across the different markets.

We also considered proxies for expected inflation. Although the common practice involves the extraction of expected inflation from fixed-income yields, in many countries, fixed-income data are very sparse or nonexistent. We investigated an alternative measure, *Institutional Investor*'s semiannual country credit risk ratings. This measure is survey based, and expected inflation plays an important role in sovereign creditworthiness. We found a significant relation between country credit risk and inflation. This analysis relies on average returns and average exposures. We also investigated out-of-sample portfolio strategies that use both inflation and country credit risk information. We found that inflation exposure reliably discriminates between low and high expected asset returns.

SUMMARY STATISTICS ON RETURNS AND INFLATION

Our equity data include 21 country total return in-

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dexes from Morgan Stanley Capital International (MSCI) and 20 total return indexes from the International Finance Corporation (IFC). Both MSCI and IFC construct value-weighted portfolios based on groups of actively traded stocks in each market. Inflation is represented by the consumer price index reported in the International Financial Statistics data base of the International Monetary Fund (IMF). In the case of Taiwan, which is not a member of the IMF, we used inflation reported in its national accounts. Our sample ends in December 1993, but the start date for each country depends on the availability of the inflation and equity data.

Most of our analysis was conducted from the perspective of a U.S. investor with a six-month horizon. Hence, our returns are calculated in U.S. dollars. These returns are attainable if the U.S. investor chooses not to hedge the currency component of the national equity return. An alternative is to calculate currency-hedged equity returns, which is feasible for many of the developed markets in our sample. For almost all of the emerging markets, however, a developed forward market does not yet exist, making currency hedging problematic. In addition, even where hedging currency exposure is possible, there is no guaranteed long-term benefit from hedging equity exposure.[4] Indeed, hedging may increase, rather than reduce, long-term equity portfolio volatility. Nevertheless, for a subsample comprising 16 countries, we collected forward interest rate data from 1977 to 1993 and assessed the influence of currency hedging on the main results.

The U.S. dollar returns essentially strip *ex post* local inflation from the country equity return. An increase in local inflation should be reflected immediately in spot exchange rates. As a result, the U.S. dollar country return is similar to a real asset return (except for the U.S. inflation rate, which is impounded into each country's return).

An understanding of the implications of currency conversion is very important for this analysis. Much previous research has examined the time-series relation between nominal returns and inflation within a particular country. Extending this analysis to other countries requires examination of local currency returns and local inflation.

Table 1 reports some summary statistics on the sample countries. The average equity returns range from –7.3 percent (Nigeria) to 54.8 percent (Colombia). Volatility is lowest in the United States, 17.9 percent, and highest in Argentina, 107.7 percent. Inflation ranges from 2.9 percent in Malaysia to 654.3 percent in Brazil.

In Table 2, the data for each country are divided into two samples: high-inflation periods and low-inflation periods. High and low are measured relative to the in-sample median inflation rate. The table reports average returns and standard deviations, as well as the average below- and above-median inflation rates. Results are based on the full sample available for each country. For a number of countries, the data begin in December 1972.

In 29 of the 41 countries, average U.S. dollar returns are higher in low-inflation states. Overall, the equally weighted country return is 9.9 percent in the high-inflation environment and 24.7 percent in the low-inflation environment. Within developed countries, the average high-inflation return is 5.6 percent and the low-inflation return is 17.2 percent. Within the emerging markets, the average high-inflation return is 14.4 percent whereas the low-inflation return is 32.6 percent. Average volatilities are similar across low- and high-inflation states for both developed and emerging markets.

These data suggest that, in general, within each country, low-inflation periods are associated with high average returns and high-inflation periods are associated with low average returns. This negative relation would appear to be consistent with the time-series evidence reported by Fama and Schwert and by others. These returns, however, are calculated in U.S. dollar terms.

We also analyzed the impact of currency fluctuations for a subset of 16 developed markets for which we have forward rate data from 1977. We examined (but do not report) four perspectives: U.S. dollar returns, local currency returns, currency-hedged returns, and exchange rate change.[5]

In the U.S. dollar perspective, 13 of the 16 countries had higher average returns during low-inflation periods. This number drops to 9 of 16 when local currency returns are examined. This difference makes sense because, to some degree, average local inflation may be reflected in the average returns measured in local currency. The currency-hedged returns were higher in low-inflation states for only 6 of the 16 countries, which indicates that inflation influences U.S. dollar returns through exchange rates. The currency changes are larger in 14 of the 15 countries in the low-inflation states (U.S. dollar not included).

We also analyzed the influence of inflation on volatility, using the same four perspectives. Although one might expect volatility to be higher in high-inflation states, this expectation is not borne out by the data. From an unhedged perspective, volatility is higher in only 4 of the 16 countries in high-inflation states. The results are similar for local currency returns and hedged returns. The most interesting aspect of these data is the volatility of the currency changes in low- and high-inflation states. In all 15 countries, currency volatility is higher in low-inflation states.

EQUITIES AS INFLATION HEDGES

Table 3 provides additional insight on the time-series

Table 1. Summary Statistics: 41 Countries

Country	Inclusion Date	Annual Average Return	Annual Volatility	Average Local Inflation	Inflation Autocorrelation	Return Autocorrelation	Local Inflation Beta[a]	OECD Inflation Beta[a]
Developed countries								
Australia	December 1972	10.45%	24.90%	8.43%	0.70	0.08	–1.01	–1.55
Austria	December 1972	12.42	32.99	4.51	0.23	0.20	–3.75	–2.38
Belgium	December 1972	14.79	26.32	5.47	0.78	0.14	–3.50	–4.23
Canada	December 1972	8.00	22.10	6.60	0.66	–0.05	–1.15	–0.64
Denmark	December 1972	11.92	22.52	7.00	0.63	0.11	–1.22	–1.66
Finland	December 1988	–3.69	28.13	3.88	–0.01	0.53	–2.65	–12.43
France	December 1972	13.54	28.42	7.22	0.84	0.19	–2.68	–3.41
Germany	December 1972	13.17	25.07	3.61	0.31	0.19	–4.23	–2.40
Hong Kong	December 1972	16.72	41.80	8.92	0.20	–0.02	–1.27	–2.06
Ireland	December 1988	8.15	26.14	2.93	0.43	–0.05	3.14	–5.95
Italy	December 1972	7.38	32.58	11.40	0.78	0.43	–1.14	–2.96
Japan	December 1972	13.26	26.17	4.84	0.79	0.11	–1.77	–2.97
Netherlands	December 1972	17.02	19.25	4.23	0.82	0.04	–2.33	–2.55
New Zealand	December 1988	8.13	27.05	3.11	0.64	0.12	–3.07	–17.68
Norway	December 1972	11.60	44.79	7.22	0.23	0.12	–2.58	0.18
Singapore	December 1972	10.75	32.54	4.25	0.72	–0.07	–1.78	–0.75
Spain	December 1972	6.81	27.64	11.54	0.79	0.35	–2.91	–3.17
Sweden	December 1972	15.82	26.39	8.01	0.35	0.12	–1.66	–1.82
Switzerland	December 1972	13.44	22.90	3.84	0.40	0.10	–4.02	–3.39
United Kingdom	December 1972	13.27	28.89	9.18	0.46	–0.04	1.20	–2.09
United States	December 1972	10.64	17.92	6.05	0.68	–0.15	–2.21	–1.92
Average		11.12	27.83	6.30	0.54	0.12	–1.93	–3.61
Emerging markets								
Argentina	December 1983	33.60	107.70	315.05	0.60	–0.08	0.02	13.58
Brazil	December 1983	17.16	77.49	654.32	0.46	–0.11	–0.01	–2.42
Chile	December 1976	30.73	57.53	22.97	0.27	0.24	2.39	7.69
Colombia	December 1985	54.79	62.15	25.77	–0.73	–0.06	–3.64	–24.09
Greece	December 1976	2.46	62.00	18.09	0.31	0.19	0.68	–4.35
India	December 1976	17.37	27.22	8.83	0.23	0.04	0.84	0.80
Indonesia	December 1990	8.21	50.48	8.22	–0.53	0.11	–0.22	–31.83
Jordan	December 1979	8.96	21.59	6.61	0.11	–0.15	0.12	2.48
Korea	December 1976	18.71	41.23	8.87	0.54	–0.04	–1.07	–1.22
Malaysia	December 1985	23.37	34.57	2.90	0.22	–0.35	4.56	–2.87
Mexico	December 1976	26.76	59.26	44.70	0.67	0.00	–0.13	–5.42
Nigeria	December 1985	–7.35	33.97	31.74	–0.30	–0.09	–0.25	13.48
Pakistan	December 1985	25.12	47.64	8.53	0.24	0.00	0.01	–5.02
Philippines	December 1985	54.80	73.82	9.57	0.57	0.34	–9.31	–39.34
Portugal	December 1986	14.53	68.68	9.98	0.17	0.23	–5.08	–16.24
Taiwan	December 1985	30.90	56.06	3.16	–0.60	0.12	–7.04	–3.41
Thailand	December 1976	26.75	39.61	5.99	0.37	0.02	–2.51	–6.39
Turkey	December 1987	13.12	107.47	66.47	–0.40	0.32	–2.07	22.75
Venezuela	December 1985	26.70	97.85	38.26	0.15	0.23	–1.01	34.08
Zimbabwe	December 1982	20.54	70.83	18.94	0.50	0.16	–4.44	–2.33
Average		22.36	59.86	65.45	0.14	0.06	–1.41	–2.51

Note: Returns calculated in U.S. dollars using nonoverlapping six-month periods. Sample ends in December 1993.
[a]Inflation betas calculated by regressing U.S. dollar returns on the local or the OECD inflation rate.

Sources: Morgan Stanley Capital International and International Finance Corporation.

Table 2. Return and Volatility in High- and Low-Inflation Periods: Unhedged U.S. Dollar Returns

Country	Inclusion Date	High-Inflation Sample: Average Return	High-Inflation Sample: Volatility	High-Inflation Sample: Average Local Inflation	Low-Inflation Sample: Average Return	Low-Inflation Sample: Volatility	Low-Inflation Sample: Average Local Inflation	Low Inflation–High Inflation Return Difference	Low Inflation–High Inflation Volatility Difference
Developed countries									
Australia	December 1972	11.40%	24.43%	11.72%	9.51%	25.95%	5.23%	–1.89%	1.51%
Austria	December 1972	6.30	37.02	6.82	18.89	28.82	2.26	12.60	–8.21
Belgium	December 1972	5.64	25.13	8.39	24.72	26.59	2.64	19.08	1.46
Canada	December 1972	8.67	26.71	9.73	7.32	16.87	3.57	–1.35	–9.84
Denmark	December 1972	5.85	22.08	10.91	18.33	22.70	3.24	12.48	0.62
Finland	December 1988	1.07	26.99	6.18	–8.22	32.09	1.63	–9.29	5.10
France	December 1972	3.26	28.51	11.12	24.84	27.28	3.45	21.58	–1.23
Germany	December 1972	4.49	15.19	5.65	22.58	30.91	1.62	18.09	15.72
Hong Kong	December 1972	22.26	33.50	13.07	11.43	48.14	4.92	–10.83	12.65
Ireland	December 1988	8.47	31.73	3.92	7.83	23.00	1.95	–0.63	–8.74
Italy	December 1972	0.45	30.47	16.80	14.79	34.52	6.25	14.34	4.05
Japan	December 1972	2.66	22.03	8.58	24.96	28.13	1.22	22.29	6.09
Netherlands	December 1972	8.91	18.53	6.91	25.74	18.80	1.63	16.83	0.27
New Zealand	December 1988	–6.37	27.28	5.11	24.87	25.37	1.16	31.24	–1.91
Norway	December 1972	4.65	51.28	10.60	19.01	38.14	3.94	14.35	–13.15
Singapore	December 1972	5.01	32.52	8.27	16.81	32.92	0.37	11.80	0.40
Spain	December 1972	–8.01	20.54	16.58	24.02	29.55	6.71	32.03	9.01
Sweden	December 1972	13.38	26.16	10.97	18.32	27.17	5.13	4.94	1.01
Switzerland	December 1972	8.51	22.43	6.16	18.59	23.44	1.57	10.09	1.00
United Kingdom	December 1972	6.97	34.94	14.52	19.94	21.64	4.08	12.97	–13.30
United States	December 1972	3.92	19.77	8.93	17.79	15.05	3.25	13.87	–4.72
Average		5.59	27.58	9.57	17.24	27.48	3.13	11.65	–0.10
Emerging markets									
Argentina	December 1983	10.30	118.29	1,056.53	61.81	100.10	48.95	51.52	–18.19
Brazil	December 1983	8.40	64.85	1,513.35	26.64	90.94	252.69	18.24	26.09
Chile	December 1976	40.51	67.08	33.11	21.64	46.81	13.60	–18.86	–20.27
Colombia	December 1985	14.88	28.54	34.16	108.57	73.52	17.90	93.70	44.98
Greece	December 1976	5.24	81.89	22.69	–0.25	33.70	13.65	–5.49	–48.19
India	December 1976	21.31	23.63	12.07	13.55	31.00	5.69	–7.75	7.37
Indonesia	December 1990	–14.42	50.58	11.54	36.82	53.78	4.99	51.24	3.20
Jordan	December 1979	10.90	24.80	14.73	7.05	18.64	–0.93	–3.85	–6.16
Korea	December 1976	15.69	49.49	14.91	21.81	32.52	3.16	6.12	–16.97
Malaysia	December 1985	33.06	35.99	4.24	14.39	34.52	1.58	–18.67	–1.47
Mexico	December 1976	13.10	74.65	83.38	42.06	40.58	14.18	28.96	–34.07
Nigeria	December 1985	–6.01	28.03	62.02	–8.68	41.04	7.12	–2.68	13.01
Pakistan	December 1985	17.07	29.20	11.49	33.73	62.27	5.65	16.66	33.07
Philippines	December 1985	41.33	64.42	13.86	69.56	85.38	5.45	28.22	20.96
Portugal	December 1986	–3.90	31.57	12.93	36.50	91.50	7.10	40.40	59.93
Taiwan	December 1985	27.36	56.01	5.78	34.55	59.88	0.60	7.19	3.87
Thailand	December 1976	11.13	31.25	9.91	44.58	44.53	2.20	33.45	13.28
Turkey	December 1987	1.03	94.49	72.28	26.67	125.83	60.85	25.64	31.34
Venezuela	December 1985	42.02	126.57	53.95	13.02	62.06	24.17	–29.00	–64.51
Zimbabwe	December 1982	–2.00	72.23	28.17	48.26	69.79	10.37	50.27	–2.45
Average		14.35	57.68	153.55	32.62	59.92	24.95	18.26	2.24

Note: Returns calculated in U.S. dollars using nonoverlapping six-month periods. High- and-low inflation periods defined relative to each country's in-sample median inflation rate. Sample ends in December 1993.

Sources: Morgan Stanley Capital International and International Finance Corporation

relation between inflation and asset returns. We analyzed the sensitivity of asset returns to changes in local inflation. When we examined the effect of monthly local currency returns on local inflation using a one-month time horizon, we found that the coefficient is negative for 30 of the 41 countries. In 16 of the 21 developed markets, the coefficient is negative. The coefficient is positive for many of the high-inflation emerging markets such as Argentina, Brazil, and Mexico.

An examination of the serial correlation of inflation rates confirms this intuition. A number of countries exhibit negative serial correlation (see Table 1). The negative autocorrelation could be symptomatic of reporting problems. The longer horizon rates increase the signal-to-noise ratio. In addition, long-horizon inflation may be more relevant for portfolio investors, who typically participate in the equity market with horizons greater than one month.

Table 3 also reports six-month and one-year horizons based on nonoverlapping data. We also estimated the sensitivities using overlapping inflation and returns for six-month, one-year, and two-year horizons.

The longer horizon results are similar to the monthly results. This similarity is depicted in Figure

Table 3. Local Currency Return Exposure to Local Inflation

Country	One Month	Six Months	One Year	Six Months Overlapping	One Year Overlapping	Two Years Overlapping
Developed countries						
Australia	–0.91	–0.88	–1.03	–0.90	–0.74	–0.75
Austria	0.42	–1.88	–3.71	–2.11	–4.20	–3.89
Belgium	–0.54	–2.21	–2.55	–2.38	–2.28	–1.92
Canada	–1.14	–1.04	–0.71	–0.77	–0.48	0.03
Denmark	–1.26	–0.58	–0.91	–1.04	–0.59	0.51
Finland	0.89	–0.72	–13.52	–3.95	–11.30	–7.31
France	–0.34	–1.30	–1.58	–1.26	–1.41	–0.78
Germany	–1.65	–1.75	–2.68	–1.75	–2.67	–2.09
Hong Kong	0.91	–1.33	–3.95	–2.36	–1.91	–0.34
Ireland	–3.63	–9.78	–3.45	–7.53	–3.31	0.38
Italy	0.24	–0.12	–0.45	–0.12	–0.19	0.08
Japan	–0.54	–1.19	–1.62	–1.29	–1.51	–1.32
Netherlands	–0.92	–2.17	–1.47	–1.60	–1.44	–0.85
New Zealand	–0.33	–0.74	–1.32	–1.01	–1.15	–1.83
Norway	–2.56	–2.81	–14.63	–6.37	–11.64	–10.27
Singapore	–0.28	–2.18	–2.29	–1.60	–1.53	–0.39
Spain	–1.12	–2.60	–2.37	–2.04	–2.12	–2.07
Sweden	–0.06	–0.39	–2.36	0.21	–1.09	–0.49
Switzerland	–1.17	–2.58	–2.89	–2.48	–3.03	–2.52
United Kingdom	1.14	1.49	1.41	0.99	0.26	–0.28
United States	–2.69	–2.21	–1.78	–2.15	–1.85	–1.30
Median	–0.54	–1.33	–2.29	–1.60	–1.53	–0.85
Emerging markets						
Argentina	0.73	2.63	4.59	1.93	1.31	1.23
Brazil	0.97	1.18	1.63	1.08	1.06	1.11
Chile	0.32	1.90	2.22	2.10	3.07	4.00
Colombia	–0.47	–2.30	–4.27	–0.93	–0.65	–3.58
Greece - IFC	–0.76	1.58	–1.03	–0.22	–0.62	–1.81
India	–0.13	0.99	0.19	1.26	2.47	1.78
Indonesia	–0.67	–0.28	4.67	–4.45	–1.83	–11.13
Jordan	0.47	0.99	1.20	1.16	1.38	1.38
Korea	–0.96	–0.33	–1.08	–0.50	–0.64	–0.58
Malaysia - IFC	2.74	6.63	8.14	5.44	2.02	0.48
Mexico	1.18	1.48	1.08	1.46	2.37	1.95
Nigeria	0.25	0.40	0.37	0.25	0.01	–0.08
Pakistan	–0.82	0.46	–0.35	0.60	1.91	4.75
Philippines	–0.72	–8.55	–19.30	–6.27	–13.32	–12.97
Portugal - IFC	–0.54	–6.86	–14.11	–9.93	–12.73	–8.45
Taiwan	–1.56	–4.97	–4.66	–5.10	–16.42	–23.74
Thailand	–0.90	–2.44	–2.64	–1.85	–2.21	–2.70
Turkey	–1.47	–9.02	–7.20	–5.28	–12.26	–15.06
Venezuela	–0.51	–0.92	–1.32	–1.14	–1.77	–1.89
Zimbabwe	–0.59	–4.35	–4.10	–3.82	–4.54	–3.94
Median	–0.52	0.06	–0.69	–0.36	–0.63	–1.19

Note: Slope coefficients of the regression of a country's equity return on its inflation rate.

1, which presents the negative of the inflation betas. In 29 of the 41 countries, the coefficient is negative in the two-year overlapping regressions. The median coefficient is –0.9 in the 21 developed markets and –1.2 in the emerging markets. These results are not consistent with the Fisher effect. The Fisher hypothesis suggests that nominal asset returns should move approximately one-to-one with inflation. There is considerable evidence against this hypothesis using short-horizon returns and U.S. data. Boudoukh and Richardson, however, argue that the relation has been positive for long-horizon U.S. and U.K. returns over the past 200 years.[6] Although our sample is much shorter than the Boudoukh and Richardson series, the results in Table 3, which are based on a much broader group of countries, are not consistent with their analysis. Our results suggest that, in a local currency perspective, equity investment fails to provide a hedge against local inflation exposure.

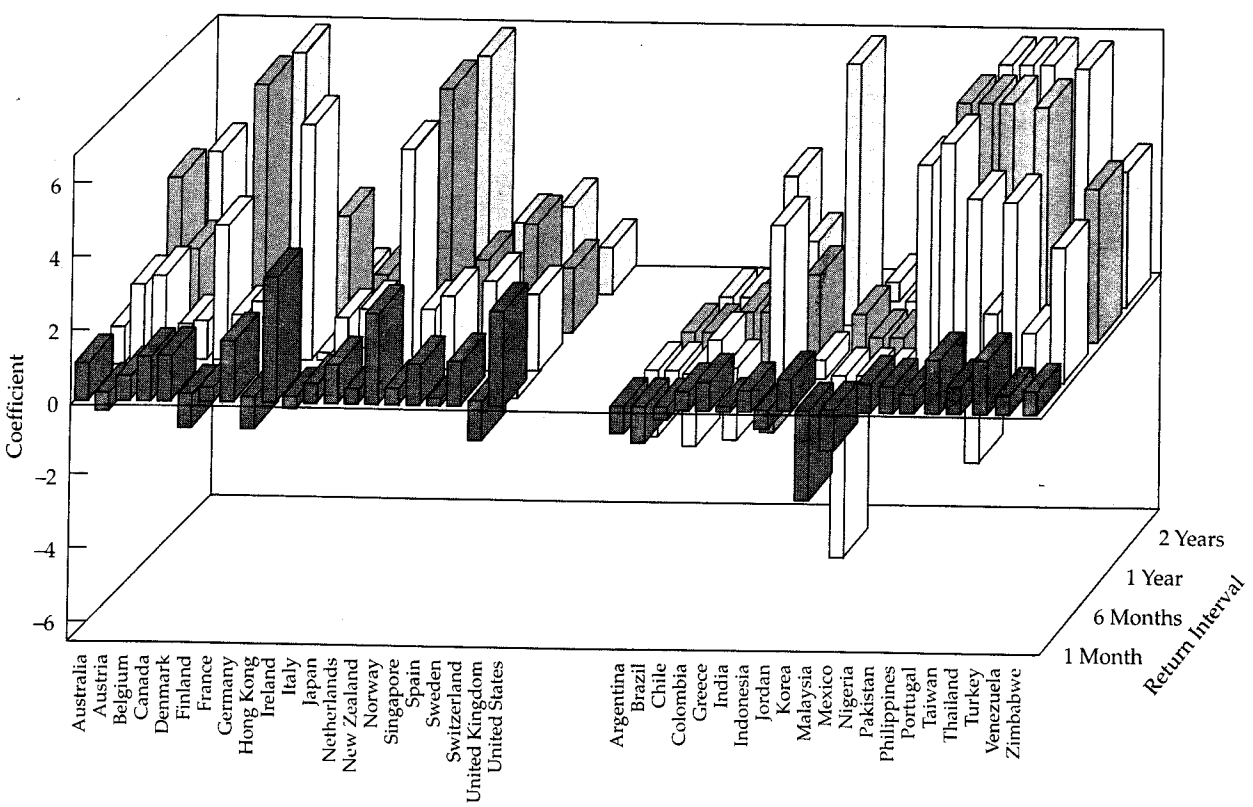
The problem with the inflation-hedging conclusion is that it relates to local currency returns. Indeed, the inflation-hedging argument applies only to an investor's home market. Hedging foreign currency fluctuations perfectly is difficult. Even where developed forward markets exist, local returns cannot be locked in because forward rates should reflect expected inflation.

U.S. dollar returns approximate real returns. In segmented capital markets (markets in which the same risk project commands different expected returns), local inflation can be considered a local risk factor. The regression coefficient is the country exposure to local inflation risk. The results in Table 4 indicate that 28 of the 41 countries have negative coefficients when measured on a monthly basis. Using a six-month horizon, 32 of 41 countries have negative exposure. For two-year returns, 35 of the 41 countries have negative exposure. The consistency of the negative exposure can be seen in Figure 2. The median coefficient for the developed market sample is –2.1 and for the emerging market sample, –1.0.

In integrated capital markets, risk exposure is usually measured relative to a world benchmark. For inflation, a number of aggregate benchmarks have been used. Ferson and Harvey proposed a trade-weighted measure of inflation in the G-7 countries and found that exposure to this factor helps explain the cross-section of expected returns in 18 developed countries.[7] Ferson and Harvey also used the more broadly based Organization for Economic Cooperation and Development (OECD) inflation rate and found that risk, measured with this factor, helps explain why expected returns vary across 21 developed markets.[8]

We estimated (but do not report in detail) inflation exposures for U.S.-dollar-based returns to the

Figure 1. Local Currency Return Exposure to Local Inflation



Note: Pillars are slope coefficients of a regression of returns on the negative of the inflation rate. Calculated using overlapping return intervals.

Table 4. U.S. Dollar Return Exposure to Local Inflation

Country	One Month	Six Months	One Year	Six Months Overlapping	One Year Overlapping	Local U.S. Two Years Overlapping
Developed countries						
Australia	–1.10	–1.01	–1.09	–0.95	–0.87	–0.84
Austria	–0.53	–3.75	–5.14	–4.00	–6.34	–6.29
Belgium	–1.14	–3.50	–3.81	–3.82	–4.22	–4.07
Canada	–1.38	–1.15	–0.78	–0.87	–0.57	–0.17
Denmark	–1.54	–1.22	–1.30	–1.75	–1.64	–0.86
Finland	0.83	–1.06	–8.99	–2.51	–4.74	–2.02
France	–1.45	–2.68	–2.63	–2.39	–2.82	–2.34
Germany	–3.09	–4.23	–5.30	–4.58	–6.74	–5.81
Hong Kong	1.11	–1.27	–4.14	–2.52	–2.32	–1.10
Ireland	2.61	1.27	3.88	1.36	4.69	7.76
Italy	–0.29	–1.14	–1.46	–1.10	–1.50	–1.34
Japan	–0.86	–1.77	–2.34	–2.05	–2.52	–2.40
Netherlands	–0.73	–2.33	–2.46	–2.43	–2.84	–2.32
New Zealand	2.55	–3.42	–6.61	–1.67	–3.21	–3.54
Norway	0.35	–2.58	–5.95	–3.08	–3.67	–2.22
Singapore	–0.10	–1.78	–2.01	–1.44	–1.45	–0.21
Spain	–1.30	–2.91	–2.91	–2.45	–2.78	–2.98
Sweden	–0.27	–1.66	–2.73	–1.02	–2.29	–2.10
Switzerland	–1.97	–4.02	–3.52	–4.33	–5.08	–4.94
United Kingdom	1.44	1.20	0.98	0.99	0.03	–0.66
United States	–2.69	–2.21	–1.78	–2.15	–1.85	–1.30
Median	–0.73	–1.78	–2.63	–2.15	–2.52	–2.10
Emerging markets						
Argentina	0.06	0.02	0.02	0.05	0.00	0.00
Brazil	0.13	–0.02	0.02	–0.02	–0.02	–0.01
Chile	0.18	0.88	0.70	1.20	1.44	2.00
Colombia	–0.58	–2.33	–3.74	–0.90	–0.32	–2.89
Greece - IFC	–0.77	0.72	–1.66	–0.75	–1.12	–2.88
India	–0.29	0.32	–1.09	0.77	0.53	–0.86
Indonesia	–0.64	–1.36	6.80	–4.56	–1.85	–11.12
Jordan	0.38	0.26	0.01	0.21	–0.03	–0.14
Korea	–1.37	–0.99	–1.56	–1.11	–1.22	–1.15
Malaysia - IFC	2.55	6.82	7.99	6.06	2.75	1.72
Mexico	0.23	0.11	–0.27	0.16	0.31	0.07
Nigeria	–0.12	–0.25	–0.15	–0.29	–0.34	–0.27
Pakistan	–0.99	0.40	–0.31	0.18	1.48	3.79
Philippines	–0.76	–8.32	–18.10	–6.55	–12.87	–12.83
Portugal - IFC	0.79	–5.43	–11.98	–7.67	–10.90	–7.52
Taiwan	–1.42	–5.11	–6.01	–5.38	–20.05	–29.39
Thailand	–0.75	–2.35	–2.60	–1.80	–2.19	–2.70
Turkey	–1.75	–9.24	–9.14	–4.87	–11.04	–12.81
Venezuela	–0.28	–0.56	–0.44	–0.74	–0.81	–0.56
Zimbabwe	–0.64	–4.26	–3.86	–3.79	–4.25	–4.21
Median	–0.44	–0.41	–0.76	–0.74	–0.57	–1.01

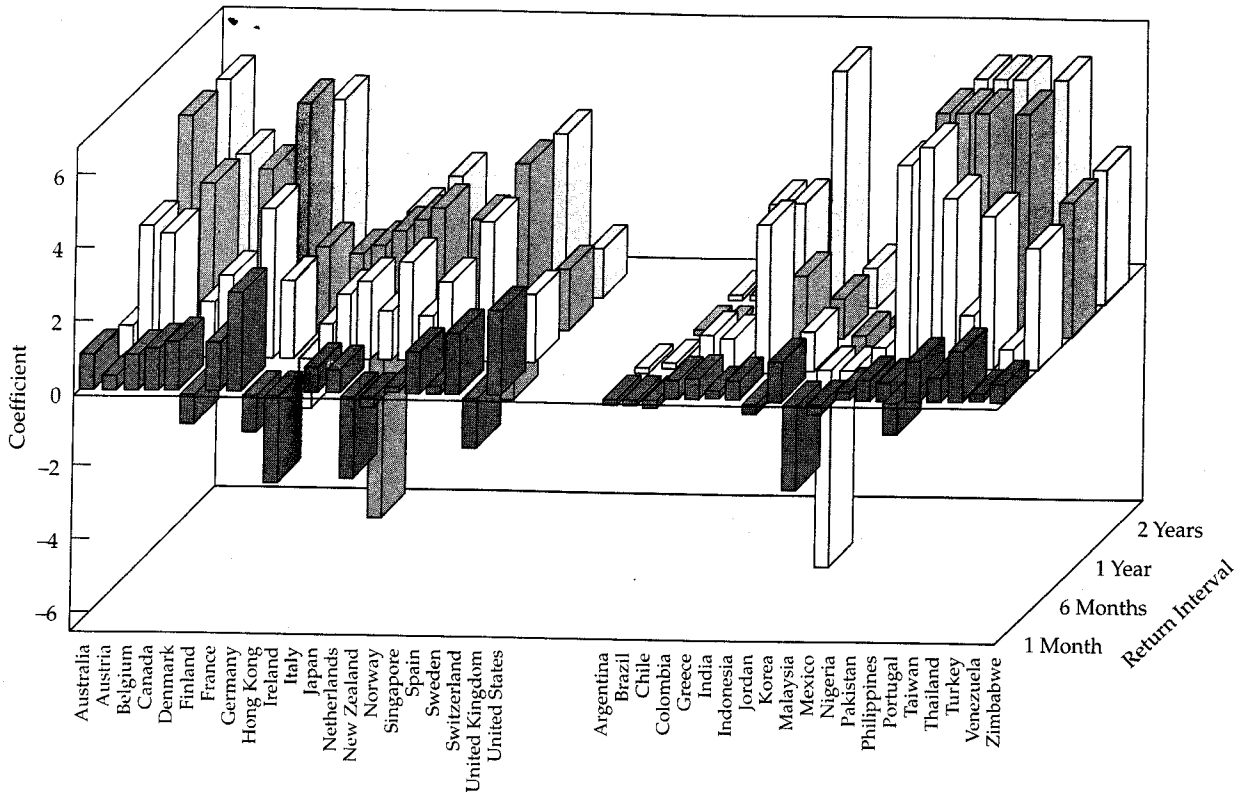
Note: Slope coefficients of the regression of a country's equity return on its inflation rate.

OECD inflation rate. In 32 of the 41 countries, the exposure to OECD inflation is negative (the six-month return betas are presented in Table 1). The betas in developed and emerging markets are sharply contrasting, however. In all but one developed country (Norway), the inflation beta is negative. In addition, with the longer horizon returns, the developed market exposures remain negative (only Canada and Singapore are positive).

For the emerging markets, the exposure to OECD inflation is rarely significant. These results are consistent with Harvey, who estimated emerging market betas with respect to five world factors (OECD inflation being one).[9]

We also analyzed (but do not report) the link between country equity returns and a world benchmark in different inflationary environments. In 25 of the 41 countries, correlations between country returns and the MSCI world return are higher in low-inflation states. In the developed market sample, the average correlation in the high-inflation states is 55.3 percent, whereas the correlation in the low-inflation states is 58.0 percent. This difference is very small and surely not significant. Of the 20 emerging markets, however, 16 have higher correlations during low-inflation states. The correlation in high-inflation

Figure 2. U.S. Dollar Return Exposure to Local Inflation



Note: Pillars are slope coefficients of a regression of returns on the negative of the inflation rate. Calculated using overlapping return intervals.

states is 11.5 percent compared with 23.4 percent in low-inflation states. This finding suggests that in periods of mild local inflation, emerging market returns move more closely with world returns.

We investigated the sensitivity of these results to currency changes. In the post-1977 sample, using unhedged U.S. dollar returns, 11 of 16 countries have higher correlation with a world benchmark in low-inflation states. In local currency terms, the same number of countries have higher correlations in low-inflation states. When measured in local currency terms, however, the average increase in correlation is much larger. In hedged returns, 12 of the 16 countries have higher correlation in low-inflation states. The average correlation in high-inflation states is 53.0 percent, and in low-inflation states, it is 66.9 percent.

We also investigated the link between U.S. dollar return correlations with the MSCI world index and correlations between local inflation rates and the OECD inflation rate. The top panel of Figure 3 presents correlations from each country's inclusion date to December 1993. There is a strong positive relation. The cross-section of inflation correlations explains 40 percent of the variation in return correlations. The lower panel of Figure 3 is based on identical samples for each country—that is, the samples are for 1972 through 1993. The results are similar. The inflation correlations explain 35 percent of the variation in the returns correlation.

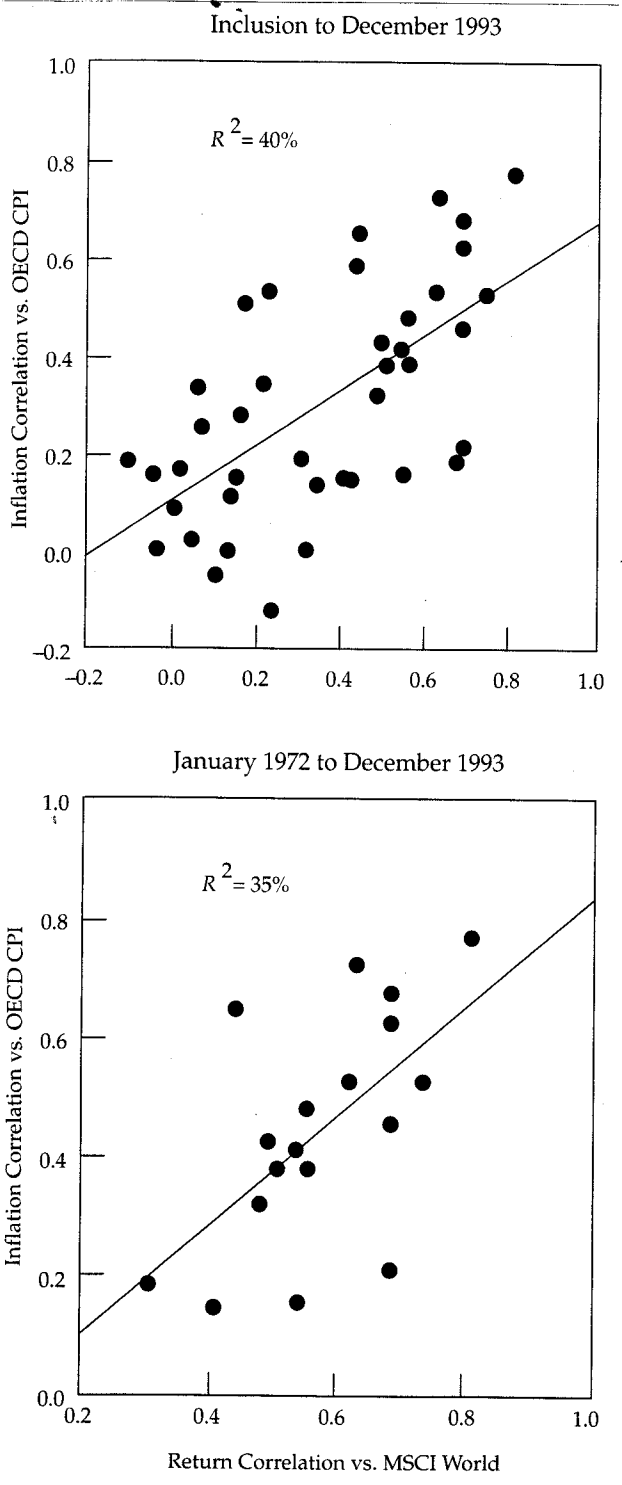
Figure 4 replicates this analysis using the United States as the benchmark. Using data from each country's date of inclusion in the sample through 1993, the country inflation correlation with U.S. inflation accounts for 28 percent of the variation in a country's return correlation with the United States. As shown in the lower panel, for the matching samples, the degree of explanatory power is reduced.

INFLATION AND THE CROSS-SECTION OF RETURNS AND VOLATILITY

The top panel of Figure 5 shows that, historically, the relationship between a county's average inflation experience and the total U.S. dollar return of its equity market has been positive. In other words, the higher a country's inflation rate relative to other countries the higher that country's U.S. dollar equity return. Because of the high-inflation experience of some emerging countries, this cross-sectional analysis uses the log of the average inflation rate. Average inflation explains 17 percent of the variation in average returns.

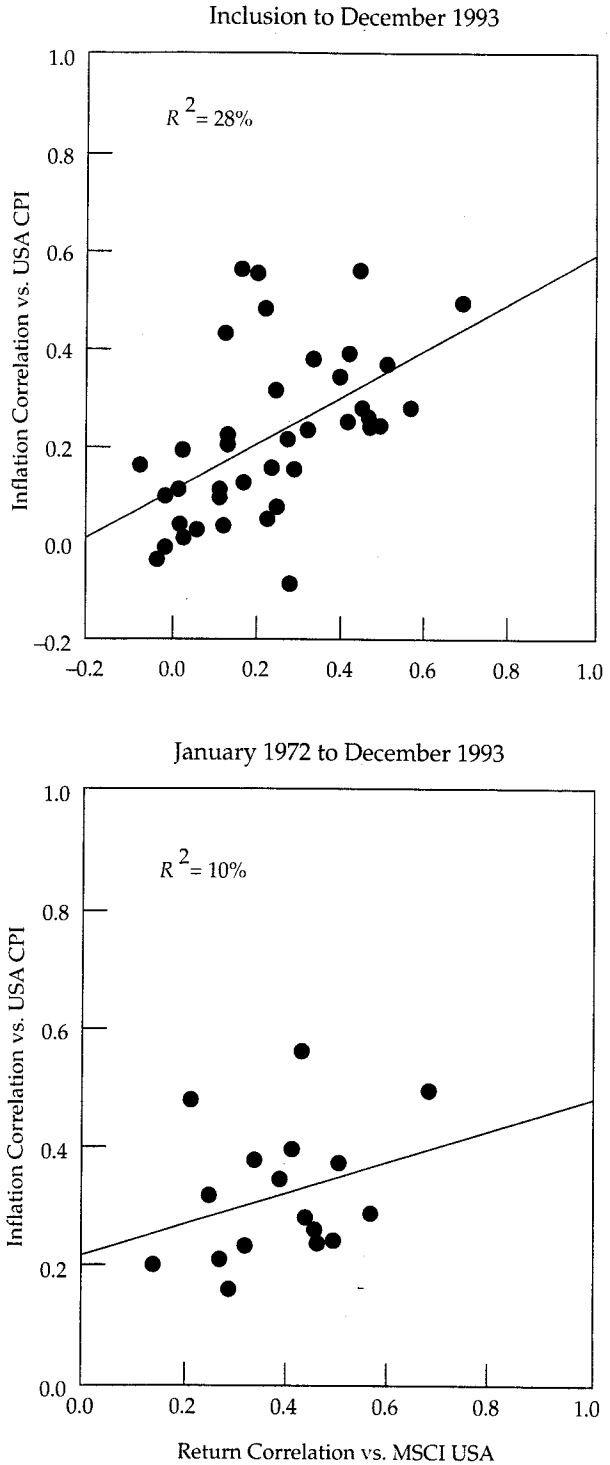
The lower panel of Figure 5 depicts the relation between volatility and average inflation. This relation

Figure 3. Country Correlations with OECD Inflation and with Equity Returns



Note: Correlations are calculated using monthly inflation rates and U.S. dollar equity returns.

Figure 4. Country Correlations with U.S. Inflation and Equity Returns

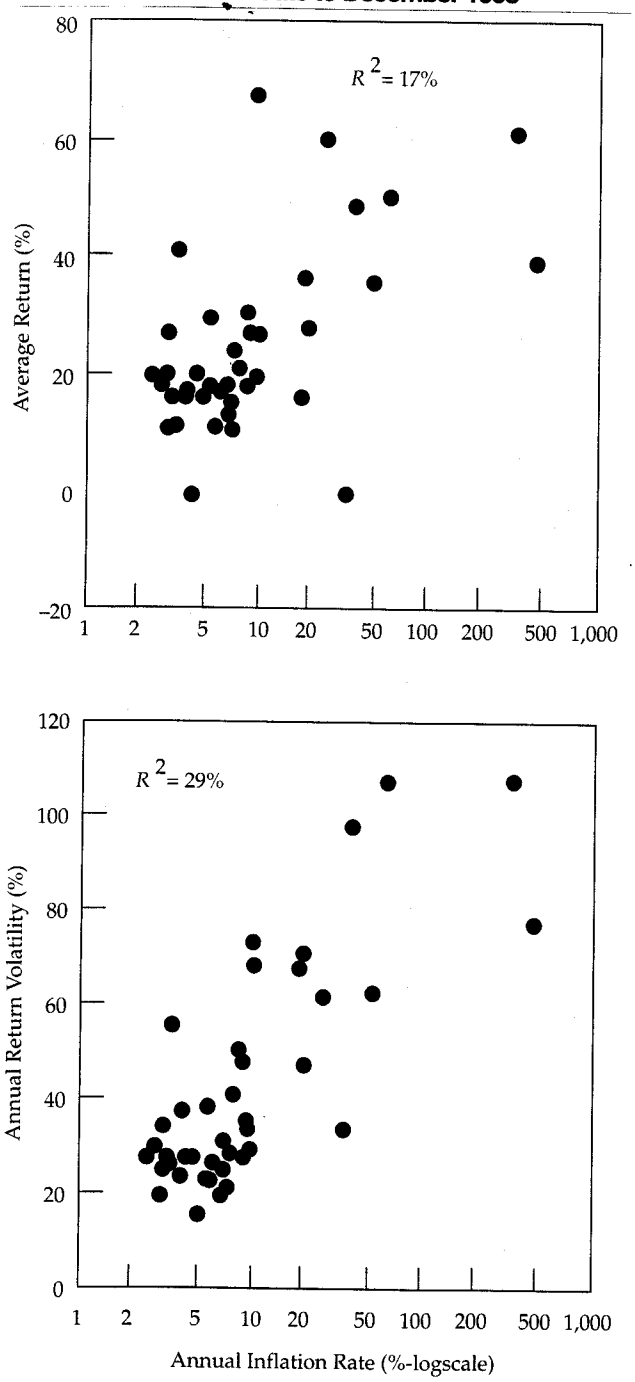


Note: Correlations are calculated using monthly inflation rates and U.S. dollar equity returns.

is sharply positive. Average inflation explains 29 percent of the cross-sectional variation in the average equity return volatility.

Changes in expected inflation and the level of expected inflation should play a prominent role in explaining the cross-section of asset returns. Actual inflation rates are important only to the extent that they provide useful information about future infla-

Figure 5. Average Returns, Inflation, and Volatility, Inclusion Date to December 1993



Note: All returns are calculated in U.S. dollars using nonoverlapping six-month return intervals.

tion. The analysis of serial correlation in Table 1 suggests that realized inflation provides some useful information about the next period's inflation.

Most of the research on expected inflation (see Fama, Fama and Schwert, and Fama and Gibbons[10]) has focused on U.S. or developed market short-horizon returns. For example, Fama demonstrated a strong relationship between short-term inflation and short-term interest rates. Equity investments, however, represent the discounted value of a long-term series of cash flows. Nevertheless, short-term inflation expectations are valuable information if the term structure of inflation is flat and stable. That is, short-horizon expected inflation is a good proxy for long-term expected inflation.

In many of these countries, the term structure of inflation expectations is not flat. In addition, expected inflation cannot be extracted from long-maturity bonds, because such bonds are not available.

One alternative is to model directly the time-series process that characterizes inflation in each country. The process is probably unstable in many countries, however, so we used forward-looking country credit risk measures to proxy inflation expectations. Erb, Harvey, and Viskanta explored the global cross-sectional and time-series relationships between country credit, inflation, and equity and fixed-income returns.[11] In general, the lower a country's perceived sovereign credit rating the higher the country's rate of inflation and the higher the expected rate of return on the country's stock and bond markets. The bankers who provide the country credit ratings are concerned about the long-term credit risk of the debtor, and lenders generally dislike inflation. Hence, a significant correlation between sovereign credit ratings and inflation is not surprising. Importantly, sovereign lending is not about making overnight loans, it represents long-term financing. Consequently, consensus sovereign credit ratings should reflect a long-term inflation expectation.

Figure 6 illustrates the negative relationship between a country's average country credit rating and the average inflation rate (low credit rating is associated with high inflation). Cross-sectional variation in country credit rating explains 51 percent of the variation in average inflation.

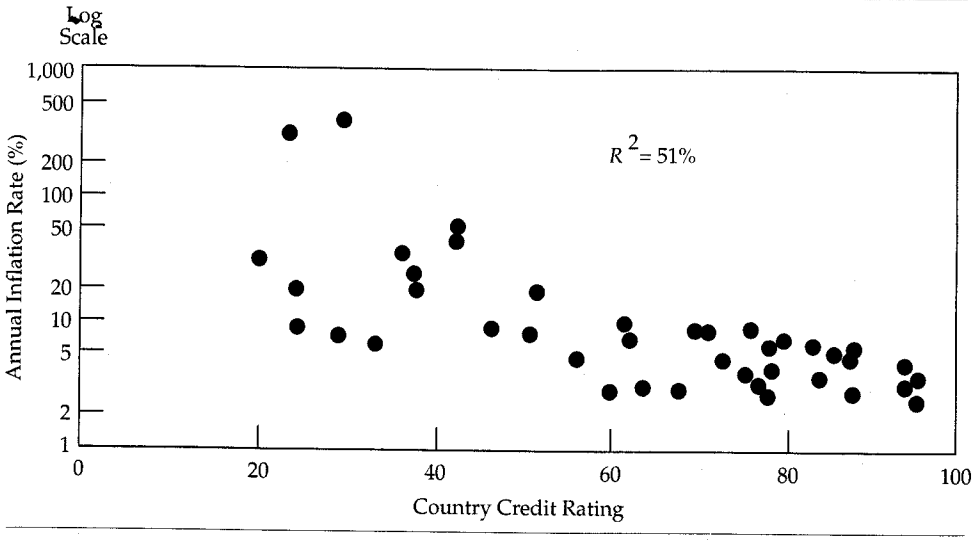
CROSS-SECTIONAL EQUITY SELECTION STRATEGIES

We investigated the information in inflation for portfolio selection by estimating the following pooled time-series cross-sectional regression:

$$r_t^* = \delta_0 + \delta_1 \, inf_{t-1} + \varepsilon_t ,$$

where r_t^* represents the returns for the 41 countries at time t. Similarly, *inf* is the inflation rate at time $t - 1$. When estimating this regression, all the months and countries are stacked together into one large regression. The coefficient δ_1 determines whether inflation is a valuable attribute in predicting both the time series and the cross-section of expected returns. The coefficients in Table 5 show that inflation provides limited information. Based on nonoverlapping three-month returns, the cross-sectional coefficient, δ_1, is positive and 1.5 standard errors from zero. This result suggests that high inflation

Figure 6. Inflation and Country Credit Rating, Inclusion Date to December 1993



is associated with high average returns. When six-month returns are used, inflation has no relation to future asset returns.

The regression was modified to allow for differential effects in emerging and developed markets. We introduced a slope dummy coefficient into the specification so that

$$r_t^* = \delta_0 + \delta_1 inf^d{}_{t-1} + \delta_2 inf^e{}_{t-1} + \varepsilon_t ,$$

Table 5. Time-series Cross-sectional Return Prediction, 1979 to 1993
(*t*-statistics in parentheses)

Regression	All Countries	Developed Countries	Emerging Countries	Hyperinflationary Countries[a]
Three-month U.S. dollar returns regressed on three-month prior inflation	0.0172 (1.529)	–1.460 (–3.771)	0.013 (1.161)	
Adjusted for hyperinflation countries		–1.261 (–3.081)	0.173 (1.604)	–0.160 (–1.491)
Three-month U.S. dollar returns regressed on three-month prior country credit	–0.002 (–6.175)	–0.002 (–5.839)	–0.003 (–4.042)	
Adjusted for hyperinflation countries		–0.002 (–5.019)	–0.003 (–3.526)	0.002 (1.420)
Six-month U.S. dollar returns regressed on six-month prior inflation	0.0064 (0.313)	–1.404 (–2.714)	–0.000 (–0.006)	
Adjusted for hyperinflation countries		–1.154 (–2.129)	0.204 (1.408)	–0.205 (–1.424)
Six-month U.S. dollar returns regressed on six-month prior country credit	–0.0021 (4.722)	–0.0025 (–4.611)	–0.0032 (–3.325)	
Adjusted for hyperinflation countries		–0.0024 (–4.101)	–0.003 (–3.021)	0.0012 (0.58856)

Note: Slope coefficients and *t*-statistics are for regressions using nonoverlapping data.

[a]Brazil and Argentina.

where inf^d_{t-1} represents inflation in developed countries and zeros in the emerging markets and inf^e_{t-1} represents inflation in the emerging markets and zeros in the developed countries. This specification allows us to assess whether the impact of inflation differs in developed and emerging markets. The results in Table 5 show a strong significant negative relation between inflation in developed markets and average returns for both the three-month and six-month returns. For emerging markets, the coefficient is only one standard error from zero for a three-month return horizon. In the six-month return regression, the coefficient is essentially zero.

We then assessed the sensitivity of these results to the influence of the hyperinflationary countries: Brazil and Argentina. We introduced an additional slope dummy variable to control for these countries:

$$r_t^* = \delta_0 + \delta_1 inf^d_{t-1} + \delta_2 inf^e_{t-1} + \delta_3 inf^h_{t-1} + \varepsilon_t,$$

where inf^h_{t-1} represents inflation in Argentina and Brazil. The results show that these two countries are very influential. In the emerging markets, the relation between inflation and asset returns is positive. In the three-month regression, the emerging market coefficient is positive and 1.6 standard errors from zero. In the six-month regression, the coefficient is 1.4 standard errors from zero. Argentina and Brazil differ considerably from the other emerging markets. The coefficients are negative in both three- and six-month regressions and 1.5 standard errors below zero.

We have argued that a country's credit rating could be considered a proxy for expected inflation. The regressions were replicated by substituting the country credit rating, CCR_{t-1}, for inflation. The results indicate that credit rating has strong predictive power for the cross-section of average returns. In the three-month return regressions, credit rating enters with a coefficient that is more than 6 standard errors below zero. Hence, low credit rating (which proxies for high expected inflation) is associated with high expected returns.

When the developed and emerging markets are split, the explanatory power of credit rating remains intact and consistent across the two types of markets. For example, in the three-month regression, the coefficients on the developed countries and the emerging countries are similar and both are more than 4 standard errors from zero.

In contrast to the results for the realized inflation rate, Brazil and Argentina do not have an undue influence on the results. When separate effects are allowed for Brazil and Argentina, the explanatory power of credit rating remains robust for both developed and emerging markets. The coefficient on the credit rating for Brazil and Argentina, however, is not different from zero at conventional levels of significance.

SPECIFICATION ANALYSIS OF CROSS-SECTIONAL REGRESSIONS

We conducted extensive diagnostics on the regression specification.[12] Of particular interest was the impact of currency hedging on our results. Table 6 presents regressions based on the subset of 16 developed countries for which we could calculate currency-hedged returns (excluded countries are Finland, Hong Kong, Ireland, New Zealand, and Singapore.)

Table 6. Time-series Cross-sectional Return Prediction, 1979 to 1993
(*t*-statistics in parentheses)

Return Perspective	Inflation	Country Credit
Local currency		
Slope coefficient	0.543	
	(1.35)	
Slope coefficient		–0.002
		(–2.62)
Slope coefficient	0.32	–0.002
	(0.78)	(–2.38)
Currency hedged		
Slope coefficient	0.32	
	(0.80)	
Slope coefficient		–0.001
		(–1.10)
Slope coefficient	0.23	–0.001
	(0.57)	(–0.95)
U.S. dollar		
Slope coefficient	–0.39	
	(–0.90)	
Slope coefficient		–0.001
		(–1.56)
Slope coefficient	–0.57	–0.002
	(–1.28)	(–1.81)
FX change		
Slope coefficient	–0.86	
	(–3.94)	
Slope coefficient		0.0001
		(1.21)
Slope coefficient	–0.84	0.0002
	(–3.76)	(0.36)

Note: Regressions are based on nonoverlapping data.

The relation between inflation, country credit, and asset returns is substantially weakened, although still negative, when U.S. dollar returns are examined. Note how different the regression is from the regression reported in Table 5. In Table 5, a slope dummy variable allows for differential effects in the 21 developed markets. The intercept is forced to be constant across the 41 countries in the sample. The Table 6 regression essentially allows for a free intercept for the 16 developed countries. Another difference between the Table 5 and Table 6 regressions is the exclusion of five countries.

The local currency regressions show a positive relation between inflation and returns. This result is

consistent with earlier observations that this regression captures both the time-series prediction and the average cross-sectional experience of the countries. That is, over the sample, the high-inflation countries had greater changes in currency rates than the low-inflation countries. This relation can be seen in the currency-change regressions, in which inflation enters with a negative coefficient that is almost 4 standard errors below zero.

When the currency-hedged returns are examined, the relation between inflation, country credit, and expected return is substantially weakened. The information in inflation appears to be linked to the currency component of the expected return. Country credit rating still provides some residual information, and this measure enters the regression with its predicted negative coefficient.

INFLATION AS A PORTFOLIO ATTRIBUTE: OUT-OF-SAMPLE EVIDENCE

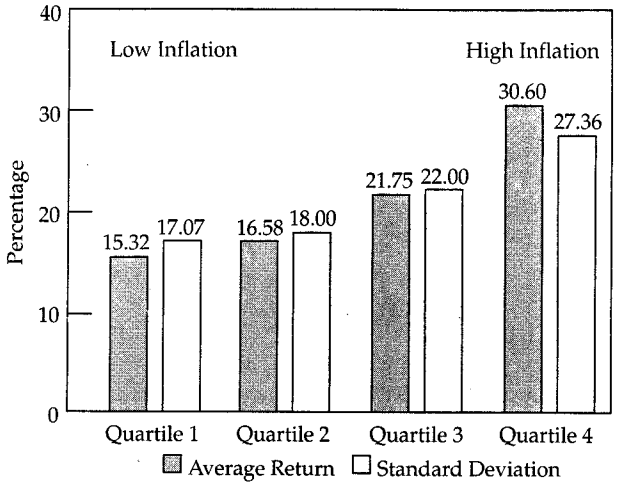
To measure the out-of-sample information of inflation and our expected inflation proxy, we divided the countries into quartiles based on each country's inflation rate. The portfolios were constructed with initial equal investments. The quartiles were updated every six months. We repeated this exercise with the country credit ratings. That is, given the decision variable, we formed portfolios and held them for half a year. At the end of six months, the portfolios were rebalanced according to new decision information. To be conservative, we allowed a six-month lag in the decision information to ensure that all information was available. For example, we used inflation in the six-month period ending December 31 in our portfolio formation at the end of June the next year.

The composition of a portfolio changes as a country's decision variable moves it into a new quartile or if the addition of a new country to the study universe moves a country into a new quartile. We looked at unhedged U.S. dollar total returns. Because the portfolios are based on lagged information, their returns can be viewed as the out-of-sample performance of a portfolio selection process.

Figure 7 shows that investing in countries with a high rate of inflation paid off. The return spread between the highest and lowest inflation quartiles exceeded 15 percentage points a year. Note, however, that the highest inflation portfolio had a return volatility that was 10 percentage points higher than the volatility of the lowest inflation portfolio. This result is consistent with the time-series cross-sectional regression results in Table 5. That is, the relation between inflation and expected returns is negative in developed markets and positive in emerging markets. The emerging markets dominate the high-inflation quartile.

We also calculated the returns to our inflation-

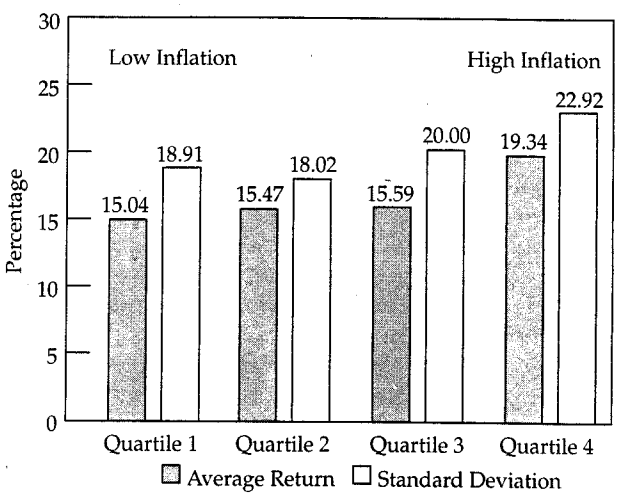
Figure 7. Country Selection Strategies Based on Inflation, All Countries, December 1979 to December 1993



Note: Returns are calculated in U.S. dollars. Each portfolio is held for six months. Countries are ranked by inflation experience lagged six months.

quartile portfolios using only developed markets. Figure 8 shows that the return spread between highest and lowest inflation quartiles is only 4 percentage points a year. The volatility spread between the high inflation and the low inflation portfolios is also about 4 percentage points a year. These results are not entirely consistent with the regression results in Table 5 and Table 6. In Table 5, the relation between expected returns and inflation is negative, which suggests that the low-inflation quartile should attain higher expected returns than the high-inflation quartile. The

Figure 8. Country Selection Strategies Based on Inflation, Developed Countries Only, December 1979 to December 1993

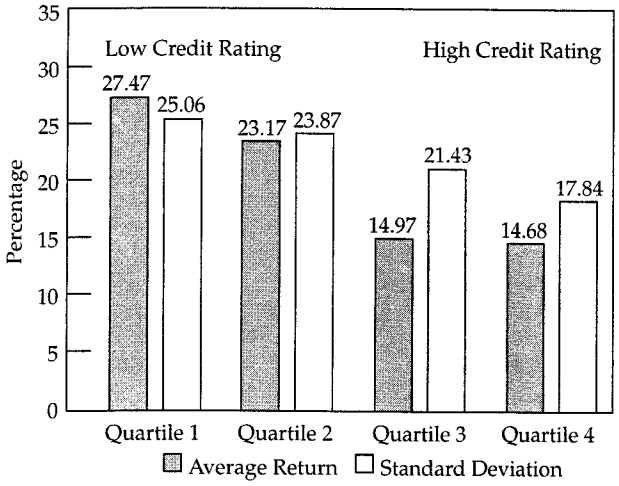


Note: Returns are calculated in U.S. dollars. Each portfolio is held for six months. Countries are ranked by inflation experience lagged six months.

sensitivity analysis in Table 6, however, indicates that the relation between measured inflation and expected returns is weak. The quartiling strategy suggests that, on average, investment in high-inflation countries produces higher returns than investments in other countries. It is not clear, however, that these returns are significantly higher, and most importantly, they are accompanied by higher risk.

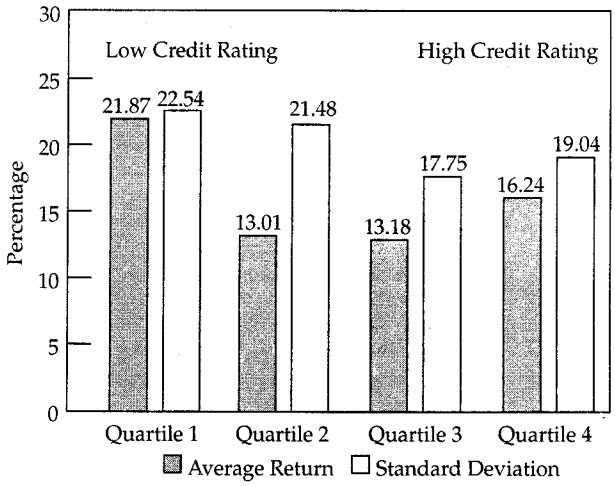
How does the long-term inflation proxy—country credit—fare? Figure 9 shows that the high–low country risk–return spread is almost 13 percentage points a year. In addition, the standard deviations are 7 percentage points higher in the low credit rating country portfolio. The ratio of return to standard deviation is 1.1 in the lowest credit rating country portfolio and 0.8 in the highest rating portfolio. Figure 10 shows that the same analysis using only developed countries produces a return spread of more than 5 percent a year and a volatility spread of more than 3 percent a year. These results are consistent with the regression results presented in Table 5 and Table 6, which show that investing in low credit rating countries should produce higher returns on average.

Figure 9. Country Selection Strategies Based on Country Credit, All Countries, December 1979 to December 1993



Note: Returns are calculated in U.S. dollars. Each portfolio is held for six months. Countries are ranked by country credit rating.

Figure 10. Country Selection Strategies Based on Country Credit, Developed Countries Only, December 1979 to December 1993



Note: Returns are calculated in U.S. dollars. Each portfolio is held for six months. Countries are ranked by country credit rating.

CONCLUSIONS

Considerable attention has been focused on the relation between inflation and asset return in large developed markets, particularly the United States and the United Kingdom. Relatively little is known about inflation in a broader set of countries. We investigated the interaction between inflation and both the time series and cross-section of expected returns in 41 national markets.

Our results confirm the negative time-series relation between realized inflation and realized asset returns when examined country by country. In contrast to recent research, we found that the negative relation is maintained when longer horizon returns are examined. On a country-by-country basis, equity returns do not serve as an inflation hedge.

We also examined the relation between inflation and the correlation of asset returns. We found that emerging market returns are more correlated with world and U.S. equity market returns in low- rather than high-inflation states. There is little difference in volatility across low- and high-inflation states in developed and emerging markets.

Next, we examined the properties of a proxy for expected inflation: country credit ratings. An important component of the credit survey is the expected course of inflation in each country. We found that average credit ratings are highly correlated with future inflation.

Finally, we examined inflation as a national equity attribute. We found that differences in inflation rates have some ability to distinguish between expected returns and have stronger power to distinguish between volatility in different countries. The differences in average inflation rates across the 41 countries can explain 31 percent of the variation in average returns. The differences in the average inflation rates can explain 59 percent of the cross-section of volatility in the same markets.

Cross-sectional time-series regressions were used to test whether inflation and credit ratings can predict country returns. Although the evidence for measured inflation rates is mixed, credit ratings appear to contain useful information for country selection strategies. The out-of-sample portfolio simulations show that country credit ratings reliably discriminate between high and low expected return countries.

NOTES

1. Eugene F. Fama and G. William Schwert, "Inflation and Asset Returns," *Journal of Financial Economics*, vol. 15, no. 2 (1977):115–46; Eugene F. Fama, "Stock Returns, Real Activity, Inflation, and Money," *The American Economic Review*, vol. 71, no. 4 (1981):545–65; Bulent Gultekin, "Stock Market Returns and Inflation: Evidence from Other Countries," *The Journal of Finance*, vol. 37, no. 1 (March 1983):49–65; and Bong-Soo Lee, "Causal Relations Among Stock Returns, Interest Rates, Real Activity and Inflation," *The Journal of Finance*, vol. 47, no. 4 (September 1992):1591–603. Also see Gautam Kaul, "Stock Returns and Inflation: The Role of the Monetary Sector," *Journal of Financial Economics*, vol. 18, no. 2 (1980):253–76; and Stan Beckers, "Stocks, Bonds, and Inflation in World Markets: Implications for Pension Fund Investment," *The Journal of Fixed Income*, vol. 1, no. 3 (1991):18–30.
2. Jacob Boudoukh and Matthew Richardson, "Stock Returns and Inflation: A Long-Horizon Perspective," *The American Economic Review*, vol. 83, no. 5 (December 1993):1346–55.
3. See Wayne E. Ferson and Campbell R. Harvey, "The Risk and Predictability of International Equity Returns," *The Review of Financial Studies*, vol. 6, no. 3 (1993):527–66; Wayne E. Ferson and Campbell R. Harvey, "Sources of Risk and Expected Returns in Global Equity Markets," *Journal of Banking and Finance*, vol. 18, no. 4 (September 1994):775–803; and Wayne E. Ferson and Campbell R. Harvey, "An Exploratory Investigation of the Fundamental Determinants of National Equity Market Returns," in Jeffrey Frankel, ed., *The Internationalization of Equity Markets*, (Chicago: University of Chicago Press, 1994):59–138.
4. See Kenneth Froot, "Currency Hedging Over Long Horizons," NBER Working Paper 4355 (May 1993); and André Perold and Evan C. Schulman, "The Free Lunch in Currency Hedging: Implications for Investment Policy and Performance Standards," *Financial Analysts Journal*, vol. 44, no. 3 (May/June 1988):45–50.
5. These results are available on request.
6. "Stock Returns and Inflation."
7. "Sources of Risk and Expected Returns."
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12. In addition, we transformed returns into returns in excess of those for an equally weighted benchmark. Inflation and country credit were also measured in excess form, and the intercept was dropped as a result.