DO WORLD MARKETS STILL SERVE AS A HEDGE?

CLAUDE B. ERB

is director of asset allocation for First Chicago Corporation. He was previously deputy chief investment officer of TSA Capital Management, as well as an analyst at Weiss, Peck and Greer, and at Trust Company of the West. Mr. Erb holds an M.B.A. from the University of California at Los Angeles.

CAMPBELL R. HARVEY

is associate professor of finance at Duke University's Fuqua School of Business and a research associate at the National Bureau of Economic Research in Cambridge, Massachusetts. He has published extensively in the area of tactical global asset allocation, and holds a Ph.D. from the University of Chicago.

TADAS E. VISKANTA

is an asset allocation analyst for First Chicago Corporation. He holds an M.B.A. from the University of Chicago.

Many active managers use state-of-the-art statistical models to forecast asset returns. Some have implemented variance forecasting models. Less effort, however, has been devoted to modeling correlations. The focus of this article is on time-varying international correlations: how correlation is affected by the state of the economy. We offer some insights into the construction of correlation forecasting models, and assess whether the hedging abilities of international capital markets for U.S. investors are undergoing change.

The most common correlation measure is the so-called unconditional correlation coefficient, which is often estimated using a sixty-month rolling window. The reason this is called "unconditional" correlation is that no information is used other than the past sixty return observations. Indeed, each of the sixty observations is equally weighted, implying that no single observation should carry more weight than any other. In other worlds, this correlation measure is not "conditioned" on any other factors.*

There are a number of modifications possible for this measure. Since October 1994, when J.P. Morgan made its RiskMetrics tools available, investors have had on-line access to over 53,000 international correlations. This correlation measure, however, is only a slight modification of the unconditional correlation. Instead of equally weighting the past sixty observations, the RiskMetrics system uses an exponentially weighted moving average with a damping factor of 0.90. This forces the most recent observations to command the highest weights. The first observation is multiplied by 0.90, the second by 0.81, etc., and the weighted observations are summed (and divided by the sum of the multiplicative factors).

The J.P. Morgan system follows the intuition that more recent data should be important for expectations about the future. This is probably true, but it is not *always* true.

Our intuition suggests that correlation should be dependent on the state of the market and the state of the economy in general. Correlations are likely different in up markets than in down markets. Correlations may also differ across the different stages of the business cycle. Our empirical results support these conjectures. The message of our research is that a simple weighting of past observations (either

equal weighting or exponential weighting) will not capture the impact of the business cycle.

STATE OF THE MARKET

There is evidence that stock return variances and correlations behave differently in up markets and in down markets. This idea, which can be traced to Sharpe [1981], is developed in an asset allocation context by Harlow [1989] and Harlow and Rao [1991]. Erb, Harvey, and Viskanta [1994] present evidence that correlations are different in up and down markets for the Group of Seven (G-7) countries. We call this analysis "semicorrelation."

Some of the sharpest evidence of this phenomenon surfaced during the stock market crash of October 1987. International markets moved more closely together in October 1987 than would have been predicted by a weighted average of past observations (see Roll [1988]). Erb, Harvey, and Viskanta [1994] find that a more general phenomena exists. Even excluding the crash observation, there are dramatic differences in correlations among the G-7 countries in up and down markets.

We expand this analysis in a number of ways. First, we move beyond the G-7 countries to consider twenty-four equity markets followed by Morgan Stanley Capital International (MSCI), twenty equity markets followed by the International Finance Corporation (IFC) of the World Bank, and nine fixed-income markets followed by Salomon Brothers. There are a total of forty-one countries in our sample (both MSCI and IFC track Greece, Portugal, and Malaysia). All the analysis is conducted in terms of U.S. returns. These are returns that are attainable by a U.S. investor who chooses not to hedge the foreign currency component of the return. The earliest available data begin in January 1970; the sample ends in September 1994.

We also track twenty-one countries' hedged returns. These returns are available only for the MSCI countries, where forward markets are readily available and liquid. The MSCI hedged return is calculated by executing a one-month forward sale on the principal amount invested at the end of each month. The hedged return will differ from the local currency return because 1) interest rates are different in different countries, and 2) there is no attempt to hedge the unknown capital appreciation/depreciation component in the forward transaction. The hedged equity returns are available from January 1988 through September 1994.

We also include a sample of international fixed-income instruments from Salomon Brothers. These bonds, available for nine countries, in each country represent a portfolio of intermediate-maturity government bonds. The data begin in April 1978 for all countries except Australia, where the series begins in November 1984. We study both hedged and unhedged returns. The hedged returns are constructed with one month forward rates from Barclays Bank. For seven of the nine countries, the data begin in January 1984. For Australia and Canada, the hedged data are available from January 1985.

The second distinguishing feature of our work is that we consider all the asset return moments: expected returns, variances, correlations, and covariances. Indeed, the up-market/down-market dichotomy is best known in the context of volatility. The most popular explanation, leverage, is proposed in Black [1976]. When the stock market moves down, the firm's market value drops, making it more risky.

When the equity value moves down, the debt-to-equity ratio must increase by definition. As a result, the firm becomes more risky (higher probability of bankruptcy), and the variance should increase. This theory applies to more than variance. Hamada [1972] links the debt/equity ratio to the firm's beta coefficient. Given that the beta is the ratio of covariance with the market to the variance of the market, and holding the market variance constant, a drop in the market must cause the covariance to increase. Indeed, even if we allow for an increase in the market variance, it works the wrong way on the beta (an increase in the denominator will decrease beta). Hence, there should be differential covariances in up and down markets according to the leverage explanation.

Expected Returns

Panel A of Exhibit 1 details returns, variances, covariances, and correlations in up and down U.S. markets for the MSCI sample. Consider the countries that do not overlap with the IFC sample. Returns range from 8.4% (Finland) to 27.9% (Hong Kong) for the full sample. When we sample returns by up markets and down markets *in the U.S.*, however, an interesting picture emerges.

First, consider the U.S. The average annualized down market return is −35.9%. Of course, it is unlikely that any annual return would be this low, because it is highly improbable that there would be twelve consecutive months of losses. The up-market annualized return is 45.0%.

EXHIBIT 1
ASSET RETURNS, VOLATILITIES, AND CORRELATIONS IN U.S. UP AND DOWN MARKETS

	Entire Sample					Up Market					Down Market				
Start	Annual Return (%)	Annual S.D. (%)	Covariance x1000	Correlation	No. of Months	Annual Return (%)	Annual S.D. (%)	Covariance x1000	Correlation	No. of Months	Annual Return (%)	Annual S.D. (%)	Covariance x1000	Correlation	No. of Months
Panel A. Unhedged MSCI Equity Returns															
Jan-70 World	12.03	14.55	1.5446	0.8253	297	37.06	11.12	0.6594	0.6938	173	−22.88	12.69	0.8194	0.7510	124
Jan-70 EAFE	14.15	17.42	1.0486	0.4682	297	30.22	15.74	0.3806	0.2830	173	−8.28	17.64	0.7217	0.4757	124
Jan-70 World ex-U.S.	14.05	17.55	1.1181	0.4955	297	31.10	15.49	0.4181	0.3157	173	−9.74	17.99	0.7589	0.4904	124
Jan-70 Australia	12.22	26.58	1.5944	0.4664	297	35.86	22.08	0.5294	0.2806	173	−20.77	29.35	1.2281	0.4865	124
Jan-70 Austria	14.14	21.58	0.3434	0.1238	297	17.73	20.14	0.0107	0.0062	173	9.13	23.44	0.5264	0.2611	124
Jan-70 Belgium	16.11	19.73	1.0596	0.4177	297	31.24	18.31	0.5001	0.3197	173	−4.98	20.09	0.6555	0.3793	124
Jan-70 Canada	10.78	19.04	1.7089	0.6980	297	38.72	15.55	0.7568	0.5696	173	−28.21	17.75	0.8479	0.5555	124
Jan-70 Denmark	14.77	19.36	0.7682	0.3085	297	26.39	19.64	0.3184	0.1897	173	−1.45	18.03	0.4854	0.3131	124
Jan-88 Finland	8.40	27.10	0.6366	0.2333	81	23.74	24.84	0.1070	0.0627	51	−17.67	29.47	0.3304	0.1967	30
Jan-70 France	14.32	24.18	1.3460	0.4329	297	37.67	22.00	0.4578	0.2435	173	−18.25	24.01	0.7562	0.3662	124
Jan-70 Germany	13.27	20.97	0.9174	0.3402	297	27.78	20.24	0.1711	0.0989	173	−6.97	20.65	0.8224	0.4631	124
Jan-70 Hong Kong	27.87	40.64	1.5500	0.2966	297	50.59	33.55	0.3815	0.1331	173	−3.83	47.49	1.4005	0.3429	124
Jan-88 Ireland	13.70	23.30	1.0383	0.4425	81	29.94	23.28	0.6032	0.3770	51	−13.90	21.42	0.5009	0.4103	30
Jan-70 Italy	9.77	26.93	0.7298	0.2108	297	18.29	25.46	0.3173	0.1458	173	−2.12	28.60	0.6377	0.2593	124
Jan-70 Japan	18.74	23.18	0.7717	0.2589	297	31.95	21.97	0.1755	0.0935	173	0.32	23.85	0.5691	0.2774	124
Jan-70 Netherlands	16.23	18.20	1.3268	0.5668	297	36.72	16.26	0.5029	0.3619	173	−12.37	17.60	0.8704	0.5750	124
Jan-88 New Zealand	8.82	26.09	0.6124	0.2330	81	27.35	25.88	−0.0570	−0.0320	51	−22.69	24.24	0.2924	0.2116	30
Jan-70 Norway	15.91	27.93	1.5716	0.4376	297	39.61	23.85	0.6679	0.3278	173	−17.15	30.41	0.9759	0.3732	124
Jan-70 Singapore	20.07	30.43	1.7762	0.4539	297	46.08	29.07	0.6423	0.2585	173	−16.21	29.28	1.3208	0.5246	124
Jan-70 Spain	10.45	22.90	0.8169	0.2775	297	21.56	21.61	0.3204	0.1735	173	−5.04	23.95	0.6398	0.3106	124
Jan-70 Sweden	16.59	22.54	1.1584	0.3997	297	35.32	21.52	0.3990	0.2170	173	−9.54	21.84	0.7508	0.3998	124
Jan-70 Switzerland	14.15	19.39	1.2395	0.4972	297	32.85	17.83	0.4369	0.2868	173	−11.93	19.02	0.8948	0.5469	124
Jan-70 U.K.	15.18	25.87	1.6752	0.5036	297	38.82	25.74	0.8508	0.3867	173	−17.81	22.96	0.9735	0.4931	124
Average	14.58	24.30	1.1321	0.3799		32.41	22.44	0.4046	0.2250		−11.07	24.67	0.7740	0.3873	
Jan-88 Greece	24.17	45.51	0.2132	0.0465	81	6.30	32.54	0.6181	0.2763	51	54.57	61.34	0.9311	0.2663	30
Jan-88 Malaysia	24.94	24.50	0.9378	0.3801	81	42.51	22.69	0.2344	0.1503	51	−4.93	25.43	0.7516	0.5186	30
Jan-88 Portugal	0.55	25.25	0.5833	0.2294	81	3.30	25.63	0.4657	0.2643	51	−4.13	24.96	0.5667	0.3983	30
Jan-70 U.S.	11.20	15.48	1.9910	1.0000	297	44.96	10.31	0.8814	1.0000	173	−35.89	10.40	0.8948	1.0000	124

EXHIBIT 1
CONTINUED

Start	Entire Sample: Annual Return (%)	Entire Sample: Annual S.D. (%)	Entire Sample: Covariance x1000	Entire Sample: Correlation	Entire Sample: No. of Months	Up Market: Annual Return (%)	Up Market: Annual S.D. (%)	Up Market: Covariance x1000	Up Market: Correlation	Up Market: No. of Months	Down Market: Annual Return (%)	Down Market: Annual S.D. (%)	Down Market: Covariance x1000	Down Market: Correlation	Down Market: No. of Months
Jan-70 S&P 500	11.78	15.57	1.9937	0.9955	297	45.34	10.41	0.8811	0.9906	173	−35.05	10.77	0.9168	0.9898	124
Jan-88 MSCI EM Global	26.41	22.95	0.6567	0.2841	81	38.47	20.41	0.1772	0.1263	51	5.93	26.03	0.5240	0.3532	30
Jan-88 MSCI EM Free	31.57	22.27	0.9461	0.4219	81	49.66	19.48	0.3520	0.2629	51	0.83	24.17	0.5335	0.3872	30
Panel B. Unhedged IFC Equity Returns															
Jan-89 IFC Comp Investable	27.82	20.77	0.9282	0.4312	69	42.65	17.04	0.2710	0.2199	43	3.30	24.53	0.8661	0.5954	26
Jan-85 IFC Comp	21.68	23.40	0.9373	0.3152	117	28.72	20.21	0.0592	0.0380	75	9.12	28.13	1.8104	0.6191	42
Jan-76 Argentina	66.10	99.27	0.3372	0.0277	225	48.78	73.26	−0.3445	−0.0578	135	92.07	128.94	2.7437	0.2508	90
Jan-76 Brazil	28.70	59.34	0.5352	0.0736	225	25.73	60.82	0.3852	0.0778	135	33.14	57.36	0.9973	0.2049	90
Jan-76 Chile	37.33	38.75	0.1852	0.0390	225	38.92	33.47	0.0090	0.0033	135	34.95	45.72	0.3228	0.0832	90
Jan-85 Colombia	43.09	31.31	0.3524	0.0886	117	36.55	29.80	0.7373	0.3211	75	54.77	33.95	0.3110	0.0881	42
Jan-76 Greece	8.15	35.23	0.4910	0.1137	225	7.24	30.41	0.4829	0.1952	135	9.51	41.61	0.5757	0.1631	90
Jan-76 India	20.62	27.61	−0.0124	−0.0037	225	17.57	28.19	−0.0208	−0.0091	135	25.20	26.82	0.2442	0.1073	90
Feb-90 Indonesia	4.57	32.27	0.9940	0.3101	56	34.97	30.22	−0.0657	−0.0313	35	−46.09	30.86	0.4930	0.2768	21
Feb-78 Jordan	12.68	18.37	0.1757	0.0769	200	15.18	18.85	0.1052	0.0695	125	8.51	17.58	0.0652	0.0413	75
Jan-76 Korea	24.85	31.37	0.6392	0.1662	225	31.28	32.86	0.4524	0.1692	135	15.20	28.95	0.4053	0.1650	90
Jan-85 Malaysia	18.58	27.27	1.5568	0.4493	117	37.76	24.62	0.2402	0.1266	75	−15.66	29.23	2.0136	0.6627	42
Jan-76 Mexico	30.43	43.20	1.5121	0.2856	225	53.42	40.27	0.2372	0.0724	135	−4.05	45.69	1.5873	0.4095	90
Jan-85 Nigeria	15.52	50.92	0.2853	0.0441	117	14.55	54.08	0.2760	0.0662	75	17.26	45.37	0.3976	0.0843	42
Jan-85 Pakistan	23.12	23.92	−0.0477	−0.0157	117	19.46	24.25	0.1613	0.0863	75	29.66	23.49	−0.0590	−0.0242	42
Jan-85 Philippines	47.12	37.73	1.2439	0.2595	117	65.42	35.90	0.5499	0.1987	75	14.43	39.48	0.6750	0.1645	42
Feb-86 Portugal	33.82	45.80	1.3431	0.2259	104	35.54	39.82	0.8743	0.2870	66	30.83	55.24	1.9879	0.3362	38
Jan-85 Taiwan	38.37	52.11	0.9631	0.1455	117	43.11	47.33	0.0653	0.0179	75	29.90	60.24	2.0980	0.3350	42
Jan-76 Thailand	25.59	27.08	0.4638	0.1397	225	29.08	25.41	0.0319	0.0154	135	20.37	29.49	0.8332	0.3331	90
Jan-87 Turkey	43.83	74.56	0.0135	0.0014	93	14.12	69.88	0.4886	0.0913	59	95.38	80.97	1.9813	0.2244	34
Jan-85 Venezuela	25.36	46.58	−0.3505	−0.0592	117	18.24	46.07	0.1944	0.0547	75	38.08	47.82	−0.6203	−0.1248	42
Jan-76 Zimbabwe	14.53	34.92	0.1001	0.0234	225	22.70	32.44	0.0915	0.0347	135	2.29	38.27	−0.5395	−0.1662	90
Average	28.12	41.88	0.5391	0.1196		30.48	38.90	0.2476	0.0895		24.29	45.35	0.8257	0.1808	

These statistics are not greatly influenced by the October 1987 observation. Excluding this observation, the average negative return is 34.1% (not reported).

The three graphs of Exhibit 2 present a histogram of the distribution of U.S. returns in up and down markets. The medians are consistent with the arithmetic averages.

What about the other countries? Harvey [1991] shows that the average correlation between the U.S. and MSCI markets is 41%. Hence, we should expect that bad news in the U.S. may also be associated with bad news in international markets. The degree of coherence suggested in Exhibit 1, however, is much greater than one might expect, given a correlation coefficient of 41%. All but two countries, Austria and Japan, have negative returns when the U.S. return is negative. For Japan, the return is 0.3% compared to 18.7% in the overall sample. The effect of U.S. down-market returns is very evident in Exhibit 3.

Panel B of Exhibit 1 examines the emerging markets. Harvey [1994] shows that average correlations between the developed markets and the emerging markets are less than 10%. Consistent with this low correlation, only three of twenty countries have negative returns when the U.S. return is negative. The average return of the twenty IFC countries is 24.3% when the U.S. market is down. Interestingly, the average returns in all twenty emerging markets are positive when the U.S. return is positive. The overall average return is 30.5% in times of positive U.S. market returns.

The hedged MSCI country returns are examined in Panel C. These data represent a much shorter time period (MSCI data begin in January 1988). Even in this shorter sample, there are some interesting differences. When the U.S. market return is negative, every MSCI hedged country return is negative. Similarly, during episodes of positive U.S. market returns, all hedged returns are positive. This suggests that hedging *increases* the correlation between U.S. and foreign returns.

Fixed-income returns are presented in Panel D of Exhibit 1. Cross-sectionally, these returns are not as volatile as the equity market returns. Average returns performance ranges from 7.1% in the Netherlands to 13.4% in Japan. Fixed income performance is lower during negative U.S. equity returns in five of nine countries. For example, the U.S. fixed-income average return is -4.3% when the equity market is down, and 18.1% when the equity market is up. Large differences are also found for Australia, Canada and the U.K. In France, Germany, Japan, and Switzerland, however, returns are higher when U.S. markets are down.

The positive performance of the European fixed-income markets during U.S. equity bear markets is entirely due to currency fluctuations. In Panel E, the hedged fixed-income returns are examined. Now, all nine countries have lower returns when the U.S. equity market is negative. This reinforces the results for the international equity markets that currency hedging increases correlation.

Volatility

Over the full sample, the volatility of the MSCI markets ranges from 15.5% (U.S.) to 40.6% (Hong Kong). The leverage hypothesis suggests that volatility may be greater in down-markets than in up markets. There is only limited support for this hypothesis. World market return volatility is 12.7.% (11.8% excluding October 1987) in U.S. down markets compared to 11.1% in U.S. up markets.

The Europe and Far East (EAFE) index has a slightly wider spread: 17.6% (17.2% excluding October 1987) in negative return markets, and 15.7% in positive U.S. markets. In addition, sixteen of the twenty-one markets have higher volatilities in down markets (13 of 21 excluding October 1987). This differential is displayed in Exhibit 4. Interestingly, there is little difference in the U.S. volatility in up and down markets.

There is more evidence that volatility is higher in emerging markets when the U.S. market is down. The composite IFC index has 28.1% (24.6% excluding October 1987) volatility when the U.S. market is down and 20.2% volatility when the market is up. The volatility is measured over the January 1986 to September 1994 period.

A similar pattern is detected in the IFC investable index, with 24.5% (24.5% excluding October 1987) volatility compared to 17.0% in down and up U.S. markets, respectively, measured from January 1988. Thirteen of the twenty (fifteen of twenty excluding October 1987) emerging markets have higher volatility when U.S. markets are down.

With the hedged equity returns in Panel C, the volatility difference is not as sharp. Only thirteen of the twenty-one MSCI markets have higher volatility when the U.S. is down. Many of these markets have just a trivial difference in volatility. However, the average volatility in down markets is 20.6% while the volatility in up markets is 18.4%.

EXHIBIT 1
CONTINUED

Start	Entire Sample: Annual Return (%)	Entire Sample: Annual S.D. (%)	Entire Sample: Covariance x1000	Entire Sample: Correlation	Entire Sample: No. of Months	Up Market: Annual Return (%)	Up Market: Annual S.D. (%)	Up Market: Covariance x1000	Up Market: Correlation	Up Market: No. of Months	Down Market: Annual Return (%)	Down Market: Annual S.D. (%)	Down Market: Covariance x1000	Down Market: Correlation	Down Market: No. of Months
Panel C. Hedged MSCI Equity Returns															
Jan-88 Australia	4.70	16.19	0.7164	0.4394	81	23.25	13.46	0.1555	0.1680	51	−26.83	16.57	0.2113	0.2237	30
Jan-88 Austria	11.55	28.12	0.4557	0.1609	81	24.90	25.65	−0.2715	−0.1540	51	−11.14	31.25	0.6421	0.3605	30
Jan-88 Belgium	6.95	18.18	0.9217	0.5034	81	28.88	17.43	0.1691	0.1411	51	−30.34	14.06	0.4760	0.5938	30
Jan-88 Canada	2.14	11.90	0.7931	0.6618	81	19.95	9.76	0.3064	0.4569	51	−28.14	10.05	0.2196	0.3834	30
Jan-88 Denmark	10.00	18.81	0.6826	0.3603	81	26.05	17.44	0.1324	0.1104	51	−17.29	18.70	0.3555	0.3335	30
Jan-88 Finland	3.79	27.78	0.6336	0.2265	81	26.42	24.61	−0.2027	−0.1198	51	−34.68	29.71	0.2754	0.1626	30
Jan-88 France	8.97	20.91	1.1420	0.5423	81	37.69	18.37	0.0933	0.0739	51	−39.86	17.25	0.6656	0.6771	30
Jan-88 Germany	9.76	19.86	0.8604	0.4301	81	29.95	17.07	0.0277	0.0236	51	−24.55	20.60	0.6885	0.5863	30
Jan-88 Hong Kong	24.37	25.91	1.0404	0.3986	81	48.66	24.44	0.1776	0.1057	51	−16.94	24.27	0.5960	0.4309	30
Jan-88 Italy	3.67	23.44	0.5930	0.2512	81	18.49	23.15	0.0215	0.0135	51	−21.51	22.48	0.3996	0.3119	30
Jan-88 Japan	2.99	23.76	0.8526	0.3563	81	16.07	18.98	0.3820	0.2927	51	−19.26	29.47	0.6233	0.3711	30
Jan-88 Netherlands	9.73	13.54	0.8423	0.6178	81	31.21	10.62	0.0988	0.1354	51	−26.78	11.33	0.4169	0.6453	30
Jan-88 New Zealand	0.39	25.19	0.7212	0.2843	81	20.03	24.33	0.0405	0.0242	51	−33.01	24.02	0.3332	0.2434	30
Jan-88 Norway	9.52	25.11	1.1357	0.4491	81	37.79	19.97	0.3345	0.2437	51	−38.53	27.13	0.2744	0.1774	30
Jan-88 Singapore	17.83	19.98	1.0593	0.5264	81	40.49	17.03	0.2337	0.1996	51	−20.68	19.96	0.6812	0.5986	30
Jan-88 Spain	−1.89	21.02	0.9524	0.4498	81	21.18	17.50	0.0412	0.0343	51	−41.09	21.93	0.6874	0.5498	30
Jan-88 Sweden	12.08	25.35	1.1660	0.4567	81	36.91	23.43	0.2987	0.1855	51	−30.13	24.13	0.6874	0.4996	30
Jan-88 Switzerland	13.08	17.01	1.0810	0.6312	81	36.98	12.94	0.2429	0.2730	51	−27.53	16.83	0.6266	0.6532	30
Jan-88 U.K.	5.35	16.56	1.1844	0.7103	81	32.66	13.62	0.3899	0.4164	51	−41.08	11.88	0.3870	0.5716	30
Average	8.16	20.98	0.8860	0.4451		29.35	18.41	0.1406	0.1381		−27.86	20.61	0.4867	0.4407	
May-93 Ireland	12.82	18.91	1.0273	0.7839	17	50.30	15.52	0.2155	0.4279	10	−40.72	10.89	0.2577	0.6480	7
May-93 Malaysia	35.29	34.57	0.6888	0.2874	17	61.23	38.79	−0.2239	−0.1778	10	−1.78	26.52	0.6569	0.6783	7
Panel D. Unhedged Fixed-Income Returns															
Nov-84 Australia	12.63	15.78	0.4101	0.2060	119	18.68	12.92	0.0164	0.0166	76	1.93	19.65	0.5196	0.2563	43
Apr-78 Canada	10.09	12.91	0.5863	0.3641	198	20.61	12.86	0.3457	0.3333	124	−7.54	11.35	0.0224	0.0219	74
Apr-78 France	10.52	13.53	0.1165	0.0690	198	12.33	12.77	0.2093	0.2033	124	7.48	14.77	−0.2058	−0.1544	74

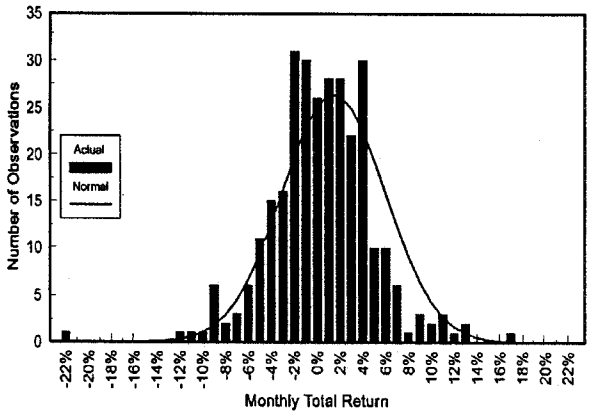
EXHIBIT 1
CONTINUED

	Entire Sample					Up Market					Down Market				
Start	Annual Return (%)	Annual S.D. (%)	Covariance x1000	Correlation	No. of Months	Annual Return (%)	Annual S.D. (%)	Covariance x1000	Correlation	No. of Months	Annual Return (%)	Annual S.D. (%)	Covariance x1000	Correlation	No. of Months
Apr-78 Germany	9.38	14.98	0.0749	0.0401	198	8.41	14.46	0.2505	0.2147	124	11.00	15.89	−0.1303	−0.0908	74
Apr-78 Japan	13.36	15.71	−0.0098	−0.0050	198	12.58	16.03	0.1574	0.1218	124	14.68	15.27	−0.2177	−0.1579	74
Apr-78 Netherlands	7.08	14.72	−0.0004	−0.0002	198	3.38	14.48	0.2333	0.1998	124	13.27	15.03	−0.0525	−0.0387	74
Apr-78 Switzerland	9.79	14.32	0.0848	0.0475	198	9.61	14.05	0.2637	0.2327	124	10.11	14.86	−0.1976	−0.1472	74
Apr-78 U.K.	11.94	17.38	0.2771	0.1278	198	13.17	17.75	0.4014	0.2805	124	9.87	16.84	−0.0445	−0.0292	74
Average	10.60	14.92	0.1924	0.1062		12.35	14.42	0.2347	0.2003		7.60	15.46	−0.0383	−0.0425	
Apr-78 U.S.A.	9.69	10.18	0.4552	0.3584	198	18.06	9.85	0.2423	0.3051	124	−4.33	9.47	0.0431	0.0504	74
Panel E. Hedged Fixed-Income Returns															
Jan-85 Australia	7.80	7.70	0.3287	0.3358	117	13.61	6.34	0.0264	0.0540	75	−2.58	9.00	0.2942	0.3146	42
Jan-85 Canada	9.46	8.64	0.3366	0.3068	117	16.55	8.10	0.2333	0.3736	75	−3.21	8.43	−0.1798	−0.2051	42
Jan-84 France	8.52	6.20	0.1947	0.2494	129	14.26	5.95	0.0351	0.0741	82	−1.48	5.58	−0.0692	−0.1238	47
Jan-84 Germany	8.13	4.50	0.0791	0.1398	129	9.51	4.52	0.0534	0.1487	82	5.73	4.41	−0.0066	−0.0148	47
Jan-84 Japan	9.53	6.24	0.0949	0.1208	129	11.22	5.72	0.0933	0.2053	82	6.60	7.04	−0.0615	−0.0873	47
Jan-84 Netherlands	7.49	4.29	0.0936	0.1732	129	9.47	4.23	0.0509	0.1513	82	4.03	4.26	−0.0192	−0.0451	47
Jan-84 Switzerland	5.73	3.87	0.0886	0.1819	129	7.70	3.82	0.0312	0.1029	82	2.30	3.80	0.0026	0.0067	47
Jan-84 U.K.	7.31	8.60	0.2332	0.2153	129	11.40	8.18	0.1390	0.2139	82	0.16	9.02	0.0098	0.0109	47
Average	8.00	6.26	0.1812	0.2154		11.72	5.86	0.0828	0.1655		1.44	6.44	−0.0037	−0.0180	
Jan-84 U.S.A.	11.05	8.65	0.3709	0.3405	129	17.70	8.14	0.2245	0.3470	82	−0.56	8.57	−0.0029	−0.0034	47

Panel D examines the global fixed-income portfolios. The average volatility when the U.S. equity market is down is 15.5%. When U.S. equity market returns are positive, the average volatility is 14.4%. Excluding the October 1987 observation has a trivial impact on the fixed-income statistics. There is no significant difference between U.S. fixed-income volatility in up and down equity markets.

The volatility of the fixed-income portfolio returns is reduced by hedging. The average hedged volatility among the countries (excluding the U.S.) is 6.3%. This compares to 14.9% in Panel D and 14.3% when the unhedged returns are sampled to have the same starting date as the hedged returns (not reported). There is a small difference between volatility calculated in down U.S. equity markets (6.4%) and in up U.S. equity markets (5.9%). Consistent with the unhedged fixed-income returns and the equity returns, the difference in volatility in up and

EXHIBIT 2A
DISTRIBUTION OF MONTHLY EQUITY RETURNS — MONTHLY TOTAL RETURNS: MSCI U.S. JANUARY 1970-SEPTEMBER 1994



down markets is not nearly as large as the differential returns performance.

Correlations and Covariances

The most interesting results in Exhibit 1 involve the correlations and covariances of world asset returns. Consistent with the results in Erb, Harvey, and Viskanta [1994], correlations are much higher when the U.S. market is down than when the U.S. market is up. (See Exhibit 5.) The MSCI world index excluding the U.S. has 49.0% correlation with the U.S. in down markets and 31.6% correlation in up markets. Although the October 1987 observation contributes to this difference, it is not the sole cause. When that observation is excluded, the correlation

EXHIBIT 2B
DISTRIBUTION OF NEGATIVE MONTHLY EQUITY RETURNS — MONTHLY TOTAL RETURNS: MSCI U.S. JANUARY 1970-SEPTEMBER 1994

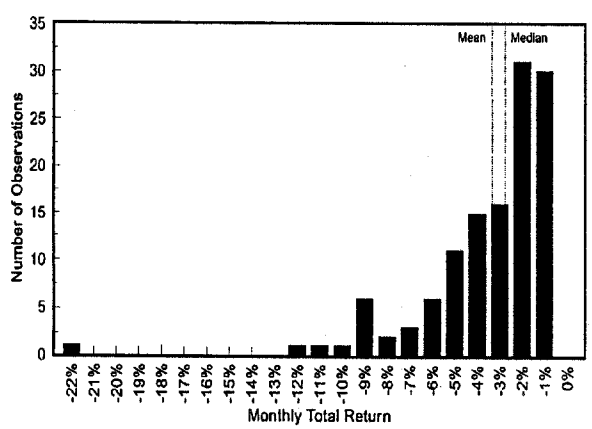
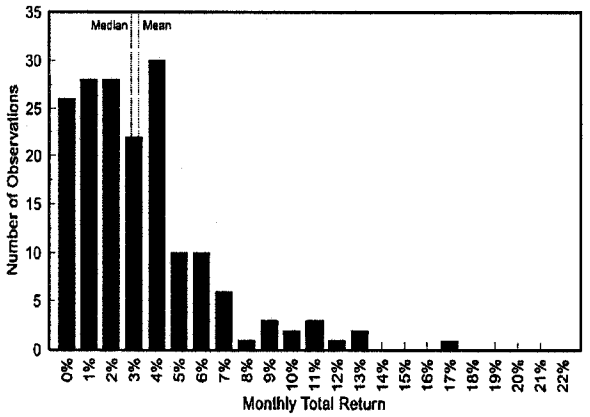


EXHIBIT 2C
DISTRIBUTION OF POSITIVE MONTHLY EQUITY RETURNS — MONTHLY TOTAL RETURNS: MSCI U.S. JANUARY 1970-SEPTEMBER 1994



in down markets is 44.2%.

Most importantly, volatility differences are not causing the variation in correlation. Because volatility is generally higher in down markets, this *reduces* correlation in down markets. Hence, additional insight can be gained into the comovement of the asset returns by examining the covariances. Both the World ex U.S. and EAFE covariances are roughly double in times of down U.S. equity returns. (See Exhibit 6.)

Similar, although less dramatic, differences are found among the emerging markets. In fourteen of twenty countries, correlations are higher when the U.S. market is negative, but these down-market correlations are still quite small compared to devel-

EXHIBIT 3
COUNTRY EQUITY RETURNS IN U.S. UP AND DOWN MARKETS

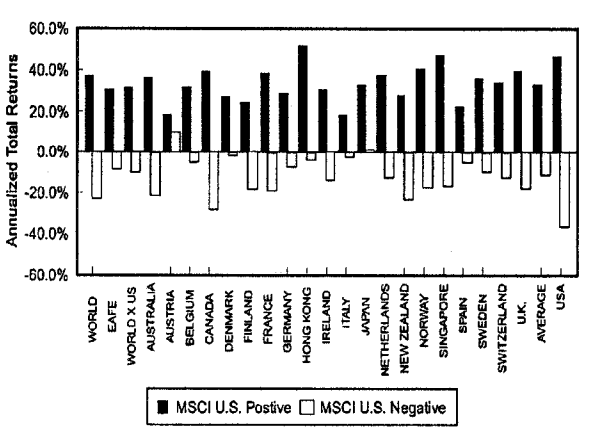


EXHIBIT 4
COUNTRY VOLATILITY IN U.S. UP AND DOWN MARKETS

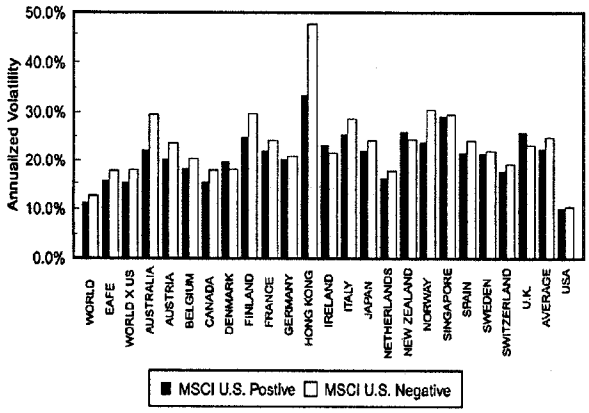
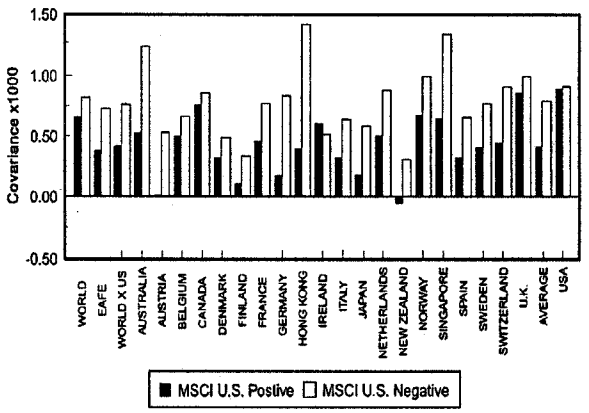


EXHIBIT 6
COUNTRY COVARIANCE WITH U.S. EQUITY RETURNS IN U.S. UP AND DOWN MARKETS



oped market correlations. The average correlation in down markets is only 18.1%. In up markets, the average correlation is 9.0%.

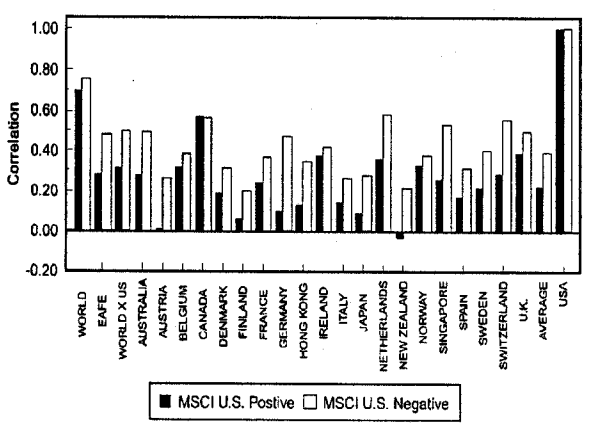
Hedging increases the correlation between U.S. returns and foreign returns. For example, the correlation between the U.S. equity market return and the unhedged German return is 34.0% (and 34.0% from January 1988). With a currency hedge, the correlation increases to 43.0% (sample begins January 1988). Similarly for Japan, the correlation with the unhedged return is 25.9% (25.2% from January 1988). This increases to 35.6% with a currency hedge.

There is a much sharper difference between hedged correlations in up and down U.S. equity markets. When the U.S. market is down, the average hedged correlation is 44.1%. When the U.S. market is up, the average correlation is only 13.8%. Because the sample begins in January 1988, these statistics are not affected by the crash observation.

The fixed-income returns in Panel D contrast with the equity findings. In down equity markets, the fixed-income correlations are significantly *lower* than in up markets. Interpretation here requires some caution. The October crash observation has a significant impact on the correlations (stock and bond markets moved sharply in opposite directions on that date). The average correlation in down markets excluding the U.S. bond market is −4.3% (8.2% excluding October 1987). In up U.S. markets, the correlation is 20.0%. In up U.S. equity markets, the correlation between U.S. equity returns and fixed income returns is 5.0% (31.9% excluding October 1987) compared to 30.5% in down markets. The international fixed-income market (not including the U.S.) provided extra hedging abilities in down equity market for the period.

Hedging fixed-income instruments makes their returns more correlated with U.S. equity returns. Using a common starting date of January 1985, the average non U.S. unhedged bond correlation with the U.S. equity return is 2.7%. The average correlation using hedged returns increases to 20.5%. However, this increased correlation is not evident in the up and down subsamples. When the U.S. equity market is down, the average hedged correlation is only −3.2%. When the U.S. equity market is up, the average correlation is 16.8%.

EXHIBIT 5
COUNTRY CORRELATION WITH U.S. EQUITY RETURNS IN U.S. UP AND DOWN MARKETS



Bull versus Bear Market Characteristics

It is obvious that if we sample the negative U.S. returns, average performance will be very poor. It is less obvious what the other countries' returns

will look like. The evidence in Exhibit 1 suggests that what happens in the U.S. has dramatic implications for world capital markets. Negative U.S. returns are overwhelmingly associated with negative returns in other countries.

Unfortunately, it is difficult to know when the U.S. return will be negative. Forecasting models used in practice can correctly predict market direction only about 60% of the time using on monthly data (see Graham and Harvey [1994]). The real message in Exhibit 1 is that world markets are profoundly affected by what happens in the U.S. The effect, of course, is not limited to returns performance alone. Volatility is often higher when returns are negative, and correlations generally increase when U.S. returns are negative. The strongest associations exist for the MSCI developed market returns, although effects are also evident for the IFC emerging capital markets.

A more fundamental measure is the U.S. business cycle. We examine causes of the differential performance through time, because the stage of the business cycle is forecastable to a considerable degree (see Harvey [1988, 1991a]).

STAGE-OF-THE-BUSINESS CYCLE AND ASSET DYNAMICS

There are many choices to make when examining the relation between the business cycle and asset return dynamics. One possibility is to sample by the stage of the business cycle within each country. For example, we could examine correlations when two countries are jointly in recession or expansion. Unfortunately, the U.S. is one of only a few countries that has semiofficial dating of business cycle turning points (by the National Bureau of Economic Research). While some additional turning point data are available from the Center for International Business Cycle Research at Columbia University, only a few additional countries are available. As a result, we choose to focus on the behavior of foreign asset returns in different stages of the U.S. business cycle.

Expected Returns in Recessions and Recoveries

Panel A of Exhibit 7 looks at average returns when the U.S. is in recession or expansions. Remarkably, average returns in all twenty-one MSCI markets are lower during U.S. recessions. Indeed, fifteen of the twenty-one countries have negative average returns. All of the countries have average returns lower than 6.3%. Across all twenty-one markets, the average return during U.S. recessions is −7.7% compared to 19.3% during U.S. recoveries. (See Exhibit 8.) This return performance reinforces the case presented in Harvey [1991b] of the effect of the U.S. business cycle on world capital markets.

This is not just a developed markets phenomenon. Sixteen of the twenty emerging markets also have lower returns during U.S. recessions. The average return across the twenty emerging markets is only 1.3% during recessions but 31.7% during recoveries. Of the ten longer-sample IFC countries, eight have lower returns during U.S. recessions. Both the IFC composite index and the IFC investable composite had negative returns during recessions, −1.8% and −15.5%, respectively.

The effect of currency hedging on equity returns is presented in Panel C. In eighteen of nineteen MSCI countries, average returns are lower during U.S. recessions than in non-recessionary periods. The average hedged return during recessions is −15.8%. Using the identical sample period, the unhedged average return is −15.8%.

Panel D details fixed-income returns. As with the bull and bear market comparisons, average returns are different for fixed-income markets across the stages of the business cycle. During U.S. recessions, the average fixed-income returns (excluding the U.S.) are slightly higher, 11.4%, compared to the average return during expansions, 10.6%. There is a much larger spread for the U.S. fixed-income return. During recessions, the average fixed-income return is 17.4% compared to 8.3% during expansions.

Hedging foreign bond returns increases the gap between recessionary and expansionary average returns. During recessions, the average non-U.S. fixed-income return is 12.8% compared to 7.7% during expansions. Interestingly, when returns are calculated over the same period as hedged returns, there is little difference between U.S. fixed-income return during recessions and expansions.

Volatility During Recessions

Volatility is generally higher during recessions. For the U.S., volatility averages 21.3% during recessions and 13.7% during expansions. Interestingly, the same effect holds for many of the MSCI countries. (See Exhibit 9.) Volatility is higher in recessions in eighteen of the twenty-one countries. For the MSCI World ex-U.S., volatility is 23.3% during U.S. recessions and 15.5% during recoveries. Similar results are found for EAFE.

EXHIBIT 7
IMPLICATIONS OF THE U.S. BUSINESS CYCLE ON RETURNS, VOLATILITY, AND CORRELATIONS

	Entire Sample					Expansions					Recessions				
Start	Annual Return (%)	Annual S.D. (%)	Covariance x1000	Correlation	No. of Months	Annual Return (%)	Annual S.D. (%)	Covariance x1000	Correlation	No. of Months	Annual Return (%)	Annual S.D. (%)	Covariance x1000	Correlation	No. of Months
Panel A. Unhedged MSCI Equity Returns															
Jan-70 World	12.03	14.55	1.5446	0.8253	297	37.06	11.12	0.6594	0.6938	173	−22.88	12.69	0.8194	0.7510	124
Jan-70 World	12.03	14.55	1.5446	0.8253	297	15.31	12.53	1.1262	0.7906	238	−1.18	20.53	3.1565	0.8834	59
Jan-70 EAFE	14.15	17.42	1.0486	0.4682	297	19.17	15.49	0.7051	0.4004	238	−6.12	22.90	2.3177	0.5814	59
Jan-70 World ex-U.S.	14.05	17.55	1.1181	0.4955	297	19.16	15.51	0.7590	0.4305	238	−6.58	23.33	2.4477	0.6027	59
Jan-70 Australia	12.22	26.58	1.5944	0.4664	297	17.52	24.27	1.0180	0.3689	238	−9.19	33.93	3.7963	0.6428	59
Jan-70 Austria	14.14	21.58	0.3434	0.1238	297	19.12	21.70	0.1113	0.0451	238	−5.95	20.21	1.1640	0.3308	59
Jan-70 Belgium	16.11	19.73	1.0596	0.4177	297	19.62	18.51	0.7674	0.3646	238	1.96	23.77	2.1567	0.5212	59
Jan-70 Canada	10.78	19.04	1.7089	0.6980	297	13.26	16.07	1.2344	0.6756	238	0.75	28.00	3.5651	0.7313	59
Jan-70 Denmark	14.77	19.36	0.7682	0.3085	297	20.00	19.02	0.5279	0.2441	238	−6.31	19.73	1.6162	0.4706	59
Jan-88 Finland	8.40	27.10	0.6366	0.2333	81	10.94	26.61	0.3442	0.1384	73	−14.74	32.47	3.3169	0.7188	8
Jan-70 France	14.32	24.18	1.3460	0.4329	297	18.46	23.15	0.9930	0.3773	238	−2.37	27.64	2.6737	0.5556	59
Jan-70 Germany	13.27	20.97	0.9174	0.3402	297	17.96	20.04	0.6105	0.2679	238	−5.65	23.77	2.0463	0.4945	59
Jan-70 Hong Kong	27.87	40.64	1.5500	0.2966	297	37.17	39.32	0.9668	0.2162	238	−9.64	44.27	3.6864	0.4783	59
Jan-88 Ireland	13.70	23.30	1.0383	0.4425	81	16.90	20.58	0.8238	0.4281	73	−15.44	41.92	3.0114	0.5054	8
Jan-70 Italy	9.77	26.93	0.7298	0.2108	297	16.29	26.57	0.4032	0.1335	238	−16.52	27.25	1.8955	0.3996	59
Jan-70 Japan	18.74	23.18	0.7717	0.2589	297	25.41	22.26	0.5790	0.2288	238	−8.16	25.31	1.3938	0.3163	59
Jan-70 Netherlands	16.23	18.20	1.3268	0.5668	297	19.20	15.98	0.9214	0.5072	238	4.25	25.16	2.8927	0.6605	59
Jan-88 New Zealand	8.82	26.09	0.6124	0.2330	81	14.91	25.60	0.4658	0.1946	73	−46.79	26.68	1.9790	0.5219	8
Jan-70 Norway	15.91	27.93	1.5716	0.4376	297	22.39	27.13	1.1737	0.3805	238	−10.20	30.03	3.0262	0.5789	59
Jan-70 Singapore	20.07	30.43	1.7762	0.4539	297	25.52	27.25	1.0963	0.3538	238	−1.89	40.51	4.3922	0.6228	59
Jan-70 Spain	10.45	22.90	0.8169	0.2775	297	15.35	22.91	0.6655	0.2554	238	−9.29	22.10	1.3139	0.3415	59
Jan-70 Sweden	16.59	22.54	1.1584	0.3997	297	20.23	21.52	0.8766	0.3582	238	1.89	26.04	2.2107	0.4878	59
Jan-70 Switzerland	14.15	19.39	1.2395	0.4972	297	19.27	17.76	0.8377	0.4147	238	−6.47	24.16	2.7415	0.6519	59
Jan-70 U.K.	15.18	25.87	1.6752	0.5036	297	17.39	21.30	1.1011	0.4547	238	6.27	39.42	3.9399	0.5741	59
Average	14.58	24.30	1.1321	0.3799		19.34	22.88	0.7759	0.3204		−7.68	29.12	2.6409	0.5302	
Jan-88 Greece	24.17	45.51	0.2132	0.0465	81	30.75	43.70	−0.2040	−0.0499	73	−35.82	60.39	4.0515	0.4720	8
Jan-88 Malaysia	24.94	24.50	0.9378	0.3801	81	28.50	23.39	0.6653	0.3042	73	−7.55	33.50	3.4421	0.7229	8

EXHIBIT 7
CONTINUED

Start	Entire Sample: Annual Return (%)	Entire Sample: Annual S.D. (%)	Entire Sample: Covariance x1000	Entire Sample: Correlation	Entire Sample: No. of Months	Expansions: Annual Return (%)	Expansions: Annual S.D. (%)	Expansions: Covariance x1000	Expansions: Correlation	Expansions: No. of Months	Recessions: Annual Return (%)	Recessions: Annual S.D. (%)	Recessions: Covariance x1000	Recessions: Correlation	Recessions: No. of Months
Jan-88 Portugal	0.55	25.25	0.5833	0.2294	81	4.02	24.11	0.3541	0.1571	73	−31.08	34.66	2.6916	0.5463	8
Jan-70 U.S.A.	11.20	15.48	1.9910	1.0000	297	12.85	13.70	1.5581	1.0000	238	4.55	21.25	3.6990	1.0000	59
Jan-70 S&P 500	11.78	15.57	1.9937	0.9955	297	13.61	13.81	1.5617	0.9943	238	4.36	21.27	3.6935	0.9975	59
Jan-88 MSCI EM Global	26.41	22.95	0.6567	0.2841	81	29.47	21.06	0.2383	0.1210	73	−1.51	37.06	4.4890	0.8521	8
Jan-88 MSCI EM Free	31.57	22.27	0.9461	0.4219	81	35.26	20.66	0.6319	0.3272	73	−2.08	34.02	3.8303	0.7920	8
Panel B. Unhedged IFC Equity Returns															
Jan-89 IFC Comp Investable	27.82	20.77	0.9282	0.4312	69	33.50	19.47	0.6627	0.3558	61	−15.46	27.19	2.9875	0.7732	8
Jan-85 IFC Comp	21.68	23.40	0.9373	0.3152	117	23.41	22.56	0.7090	0.2513	109	−1.78	34.11	4.0320	0.8315	8
Jan-76 Argentina	66.10	99.27	0.3372	0.0277	225	76.00	102.16	0.1955	0.0163	194	4.12	77.79	1.2740	0.1104	31
Jan-76 Brazil	28.70	59.34	0.5352	0.0736	225	26.99	59.99	0.2771	0.0393	194	39.38	55.95	2.1419	0.2580	31
Jan-76 Chile	37.33	38.75	0.1852	0.0390	225	40.79	38.46	0.1615	0.0358	194	15.70	40.58	0.3514	0.0584	31
Jan-85 Colombia	43.09	31.31	0.3524	0.0886	117	46.89	31.84	0.2167	0.0544	109	−8.72	18.06	2.1684	0.8448	8
Jan-76 Greece	8.15	35.23	0.4910	0.1137	225	12.14	35.76	0.3396	0.0809	194	−16.82	31.27	1.4590	0.3145	31
Jan-76 India	20.62	27.61	−0.0124	−0.0037	225	23.68	28.27	0.0380	0.0114	194	1.45	22.70	−0.3122	−0.0927	31
Feb-90 Indonesia	4.57	32.27	0.9940	0.3101	56	13.62	30.73	0.7270	0.2697	48	−49.74	38.92	2.7118	0.4903	8
Feb-78 Jordan	12.68	18.37	0.1757	0.0769	200	10.36	17.27	0.0533	0.0260	169	25.32	23.48	0.8448	0.2426	31
Jan-76 Korea	24.85	31.37	0.6392	0.1662	225	31.29	31.39	0.6731	0.1826	194	−15.46	29.10	0.4598	0.1065	31
Jan-85 Malaysia	18.58	27.27	1.5568	0.4493	117	20.64	26.73	1.4134	0.4228	109	−9.45	34.91	3.4924	0.7038	8
Jan-76 Mexico	30.43	43.20	1.5121	0.2856	225	41.14	43.06	1.3602	0.2690	194	−36.59	39.47	2.5171	0.4299	31
Jan-85 Nigeria	15.52	50.92	0.2853	0.0441	117	15.16	52.69	0.3397	0.0516	109	20.42	11.32	−0.4533	−0.2817	8
Jan-85 Pakistan	23.12	23.92	−0.0477	−0.0157	117	24.13	24.72	−0.0396	−0.0128	109	9.30	5.96	−0.1659	−0.1957	8
Jan-85 Philippines	47.12	37.73	1.2439	0.2595	117	50.82	35.70	0.8057	0.1805	109	−3.32	60.55	7.1820	0.8345	8
Feb-86 Portugal	33.82	45.80	1.3431	0.2259	104	39.12	46.59	1.2773	0.2144	96	−29.81	31.44	2.1669	0.4849	8
Jan-85 Taiwan	38.37	52.11	0.9631	0.1455	117	40.20	49.92	0.3827	0.0613	109	13.40	80.49	8.8554	0.7741	8
Jan-76 Thailand	25.59	27.08	0.4638	0.1397	225	28.95	26.66	0.3499	0.1117	194	4.63	29.28	1.1934	0.2748	31
Jan-87 Turkey	43.83	74.56	0.0135	0.0014	93	58.02	75.65	0.0897	0.0095	85	−106.89	45.00	−0.6421	−0.1004	8
Jan-85 Venezuela	25.36	46.58	−0.3505	−0.0592	117	13.48	44.46	0.0673	0.0121	109	187.31	52.80	−5.9404	−0.7916	8

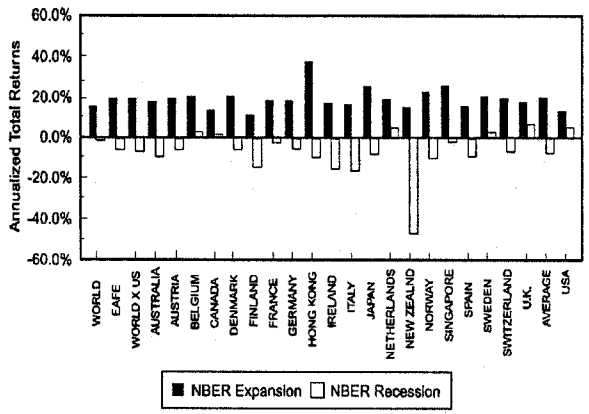
EXHIBIT 7
CONTINUED

Start	Entire Sample: Annual Return (%)	Entire Sample: Annual S.D. (%)	Entire Sample: Covariance x1000	Entire Sample: Correlation	Entire Sample: No. of Months	Expansions: Annual Return (%)	Expansions: Annual S.D. (%)	Expansions: Covariance x1000	Expansions: Correlation	Expansions: No. of Months	Recessions: Annual Return (%)	Recessions: Annual S.D. (%)	Recessions: Covariance x1000	Recessions: Correlation	Recessions: No. of Months
Jan-76 Zimbabwe	14.53	34.92	0.1001	0.0234	225	19.89	34.35	0.0351	0.0087	194	−18.97	37.44	0.5345	0.0962	31
Average	28.12	41.88	0.5391	0.1196		31.67	41.82	0.4382	0.1023		1.26	38.32	1.4919	0.2281	
Panel C. Hedged MSCI Equity Returns															
Jan-88 Australia	4.70	16.19	0.7164	0.4394	81	6.62	16.10	0.5741	0.3814	73	−12.83	17.26	2.0243	0.8252	8
Jan-88 Austria	11.55	28.12	0.4557	0.1609	81	16.68	25.40	−0.0411	−0.0173	73	−35.21	46.55	5.0136	0.7577	8
Jan-88 Belgium	6.95	18.18	0.9217	0.5034	81	8.55	17.12	0.7213	0.4506	73	−7.69	27.24	2.7585	0.7126	8
Jan-88 Canada	2.14	11.90	0.7931	0.6618	81	2.97	11.82	0.6964	0.6301	73	−5.36	13.24	1.6792	0.8924	8
Jan-88 Denmark	10.00	18.81	0.6826	0.3603	81	12.24	18.09	0.5201	0.3075	73	−10.47	25.18	2.1765	0.6082	8
Jan-88 Finland	3.79	27.78	0.6336	0.2265	81	5.85	26.71	0.3016	0.1208	73	−15.00	38.03	3.6728	0.6795	8
Jan-88 France	8.97	20.91	1.1420	0.5423	81	11.24	19.71	0.9069	0.4920	73	−11.70	30.89	3.2984	0.7514	8
Jan-88 Germany	9.76	19.86	0.8604	0.4301	81	14.30	17.21	0.5354	0.3327	73	−31.61	35.80	3.8479	0.7562	8
Jan-88 Hong Kong	24.37	25.91	1.0404	0.3986	81	25.67	25.67	0.7978	0.3323	73	12.48	29.66	3.2599	0.7732	8
Jan-88 Italy	3.67	23.44	0.5930	0.2512	81	7.75	21.82	0.3337	0.1635	73	−33.49	35.16	2.9788	0.5960	8
Jan-88 Japan	2.99	23.76	0.8526	0.3563	81	4.15	20.77	0.6103	0.3142	73	−7.61	44.75	3.0684	0.4824	8
Jan-88 Netherlands	9.73	13.54	0.8423	0.6178	81	11.02	12.71	0.6930	0.5830	73	−2.03	20.43	2.2108	0.7613	8
Jan-88 New Zealand	0.39	25.19	0.7212	0.2843	81	6.77	24.69	0.5251	0.2275	73	−57.90	24.92	2.5411	0.7175	8
Jan-88 Norway	9.52	25.11	1.1357	0.4491	81	15.03	24.83	1.0387	0.4473	73	−40.74	24.42	2.0469	0.5898	8
Jan-88 Singapore	17.83	19.98	1.0593	0.5264	81	20.53	17.34	0.6933	0.4276	73	−6.78	37.50	4.4119	0.8277	8
Jan-88 Spain	−1.89	21.02	0.9524	0.4498	81	−1.44	18.51	0.6350	0.3669	73	−5.96	39.07	3.8506	0.6934	8
Jan-88 Sweden	12.08	25.35	1.1660	0.4567	81	16.05	22.99	0.8372	0.3894	73	−24.08	42.04	4.1854	0.7005	8
Jan-88 Switzerland	13.08	17.01	1.0810	0.6312	81	15.66	15.18	0.8212	0.5784	73	−10.41	29.59	3.4644	0.8236	8
Jan-88 U.K.	5.35	16.56	1.1844	0.7103	81	5.35	16.10	1.0202	0.6776	73	5.37	21.59	2.6826	0.8742	8
Average	8.16	20.98	0.8860	0.4451		10.79	19.62	0.6432	0.3792		−15.84	30.70	3.1143	0.7275	
May-93 Ireland	12.82	18.91	1.0273	0.7839	17	12.82	18.91	1.0273	0.7839	17	N/A	N/A	N/A	N/A	N/A
May-93 Malaysia	35.29	34.57	0.6888	0.2874	17	35.29	34.57	0.6888	0.2874	17	N/A	N/A	N/A	N/A	N/A

EXHIBIT 7
CONTINUED

Start	Entire Sample: Annual Return (%)	Entire Sample: Annual S.D. (%)	Entire Sample: Covariance x1000	Entire Sample: Correlation	Entire Sample: No. of Months	Expansions: Annual Return (%)	Expansions: Annual S.D. (%)	Expansions: Covariance x1000	Expansions: Correlation	Expansions: No. of Months	Recessions: Annual Return (%)	Recessions: Annual S.D. (%)	Recessions: Covariance x1000	Recessions: Correlation	Recessions: No. of Months
Panel D. Unhedged Fixed Income Returns															
Nov-84 Australia	12.63	15.78	0.4101	0.2060	119	11.98	16.19	0.4303	0.2141	111	21.63	8.31	0.1351	0.1144	8
Apr-78 Canada	10.09	12.91	0.5863	0.3641	198	8.35	10.71	0.3648	0.2855	167	19.47	21.22	1.7819	0.5659	31
Apr-78 France	10.52	13.53	0.1165	0.0690	198	12.29	13.27	0.0180	0.0114	167	0.96	14.80	0.6442	0.2934	31
Apr-78 Germany	9.38	14.98	0.0749	0.0401	198	9.52	14.40	–0.0766	–0.0446	167	8.61	18.02	0.8913	0.3334	31
Apr-78 Japan	13.36	15.71	–0.0098	–0.0050	198	14.61	14.96	–0.1373	–0.0770	167	6.63	19.45	0.6750	0.2340	31
Apr-78 Netherlands	7.08	14.72	–0.0004	–0.0002	198	8.31	14.42	–0.0955	–0.0555	167	0.45	16.36	0.5097	0.2100	31
Apr-78 Switzerland	9.79	14.32	0.0848	0.0475	198	9.97	13.90	–0.0620	–0.0374	167	8.85	16.67	0.8755	0.3540	31
Apr-78 U.K.	11.94	17.38	0.2771	0.1278	198	9.62	17.21	0.0811	0.0395	167	24.41	18.13	1.3365	0.4968	31
Average	10.60	14.92	0.1924	0.1062	188	10.58	14.38	0.0653	0.0420		11.38	16.62	0.8562	0.3252	
Apr-78 U.S.A.	9.69	10.18	0.4552	0.3584	198	8.31	8.80	0.3508	0.3342	167	17.14	15.71	1.0197	0.4376	31
Panel E. Hedged Fixed Income Returns															
Jan-85 Australia	7.80	7.70	0.3287	0.3358	117	6.89	7.80	0.3138	0.3218	109	20.16	5.42	0.5390	0.6996	8
Jan-85 Canada	9.46	8.64	0.3366	0.3068	117	8.98	8.80	0.3064	0.2784	109	16.04	6.02	0.7528	0.8795	8
Jan-84 France	8.52	6.20	0.1947	0.2494	129	8.28	6.09	0.1441	0.1910	121	12.23	8.15	0.9598	0.8282	8
Jan-84 Germany	8.13	4.50	0.0791	0.1398	129	8.05	4.50	0.0530	0.0951	121	9.42	4.73	0.4739	0.7049	8
Jan-84 Japan	9.53	6.24	0.0949	0.1208	129	9.38	6.08	0.0531	0.0704	121	11.83	8.76	0.7273	0.5841	8
Jan-84 Netherlands	7.49	4.29	0.0936	0.1732	129	7.36	4.32	0.0712	0.1328	121	9.39	4.02	0.4327	0.7573	8
Jan-84 Switzerland	5.73	3.87	0.0886	0.1819	129	5.67	3.81	0.0679	0.1437	121	6.74	5.01	0.4028	0.5656	8
Jan-84 U.K.	7.31	8.60	0.2332	0.2153	129	6.70	8.69	0.2127	0.1973	121	16.53	7.08	0.5440	0.5407	8
Average	8.00	6.26	0.1812	0.2154		7.66	6.26	0.1528	0.1788		12.79	6.15	0.6040	0.6950	
Jan-84 U.S.A.	11.05	8.65	0.3709	0.3405	129	11.06	8.80	0.3551	0.3255	121	10.77	6.53	0.6112	0.6589	8

EXHIBIT 8
COUNTRY EQUITY RETURNS BASED ON U.S. ECONOMIC STATE



The effect of the U.S. business cycle on volatility in emerging markets is limited. Nine of the twenty emerging markets have higher volatility during U.S. recessions. Of the longer-sample IFC countries, three have higher volatility during recessions. Across all countries, the average volatility is 38.3% during U.S. recessions and 41.8% during U.S. expansions. The value-weighted IFC composite has 34.1% volatility during recessions and 22.6% volatility during U.S. recoveries. A similarly large spread in volatility exists in the investable composite.

Hedged returns are presented in the final two panels. In eighteen of nineteen countries (Norway is the exception), volatility is higher during U.S. recessions. In many countries, hedged return volatility is lower than unhedged return volatility. For example, the U.K. hedged volatility is 16.6%. Unhedged volatility estimated over the same sample period is 19.2%. Volatility of hedged returns is 19.9% compared to 22.1% for unhedged returns over the same sample.

If anything, hedged equity returns have greater asymmetry across the business cycle. During recessions, hedged volatilities are 30.7%. During expansions, the hedged volatilities are 19.6%. Measured over the same period (beginning in January 1988), the spread between the unhedged volatilities in recessions and expansions is 10.2%.

International (ex-U.S.) fixed income volatility is higher during recessions than expansions: 16.6% compared to 14.4%. U.S. fixed-income returns are much more volatile during recessions: 15.7% compared to 8.8%. Hedged fixed-income portfolios are much less volatile. Hedging cuts the average (non-U.S.) bond volatility in half. In addition, there is no significant difference between average volatilities during recession and expansion.

Correlations and Covariances and the Business Cycle

There are sharp differences in correlations across stages of the business cycle. In all twenty countries, correlations with the U.S. increase during recessions. For example, Germany's correlation during recession is 49.5% compared to 26.8% during recoveries. Australia's correlation is 64.3% during recession and 36.9% during recoveries. Across all twenty countries, the average correlation is 53.0% in recession and 32.0% during expansions. (See Exhibit 10.)

The Canadian correlation deserves further scrutiny. There are large differences in volatility for both the U.S. and Canada during recessions and expansions (larger in recessions). The product of the

EXHIBIT 9
COUNTRY VOLATILITY BASED ON U.S. ECONOMIC STATE

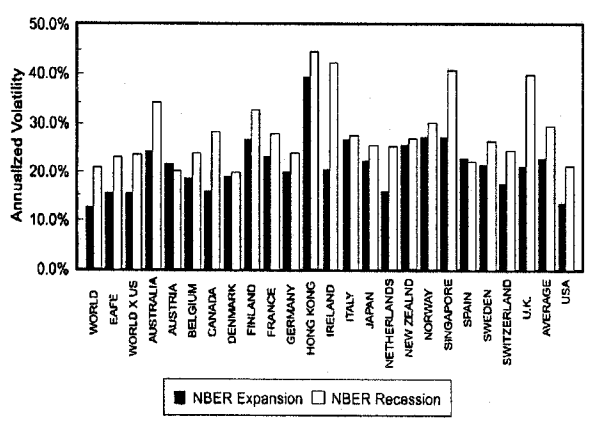


EXHIBIT 10
COUNTRY CORRELATION WITH U.S. EQUITY RETURNS BASED ON U.S. ECONOMIC STATE

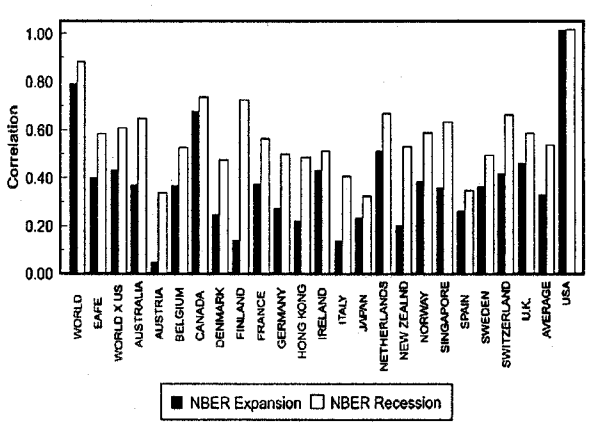
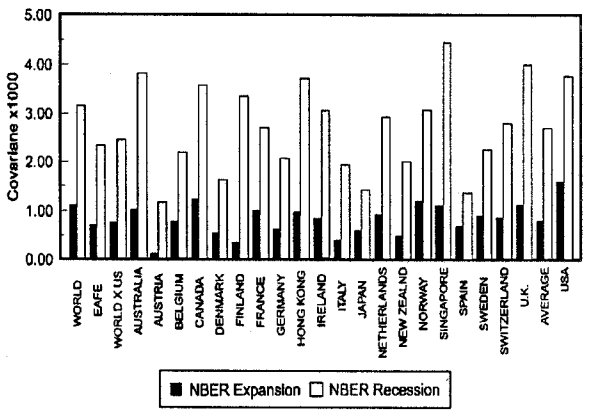


EXHIBIT 11
COUNTRY COVARIANCE WITH U.S. EQUITY RETURNS BASED ON U.S. ECONOMIC STATE



U.S. and Canadian volatilities in the denominator of the correlation coefficient increases, going from expansion to recession, thereby reducing the correlation in recession. Although correlations drop during U.S. recessions, covariances increase. Indeed, the covariance between the Canadian and U.S. returns increases by threefold during recessions.

Furthermore, covariance increases are also found in all other countries. For example, covariance with the U.S. return roughly doubles for Germany and Japan. For the U.K., covariance more than triples. (See Exhibit 11.)

A similar, although less pronounced, correlation and covariance effect is found among the emerging markets. In fourteen of the twenty IFC markets, correlations are higher during U.S. recessions. In the longer-sample IFC countries, the correlations are higher in eight of the ten countries. The average correlation in recession is 22.8%, while the average correlation in recovery is 10.2%.

The effect of currency hedging is presented in Panel C of Exhibit 7. In all nineteen equity markets, hedged return correlations are higher in recessions than in recoveries. Hedging tends to increase correlations. For example, the correlation between the U.S. and unhedged Japan is 25.9% (24.2% since January 1988), while the hedged correlation is 35.6% (with data beginning in January 1988). The U.S.-unhedged U.K. correlation is 50.3% (58.9% since January 1988) while the hedged correlation increases to 71.0%. This is also true with the covariances. In general, the covariances between U.S. and foreign returns are much higher when hedged.

Fixed-income analysis is presented in Panel D. The unhedged non-U.S. fixed-income correlations are sharply higher during U.S. recessions. The average correlation is 32.5% during recession and only 4.2% during expansions. The difference between the U.S. equity and U.S. fixed income correlations across the stages of the business cycle is smaller. We know that both the U.S. fixed-income and equity volatilities are much higher during recession, however. Hence, covariance must increase substantially during recession. Indeed, U.S. fixed-income equity covariances are three times higher in recessions than in expansions.

Currency hedging increases correlations. The average non-U.S. fixed-income correlation is 10.6% (2.7% from January 1985). With hedged fixed income returns, the correlation increases to 21.5%. Currency hedging substantially changes the recession/expansion correlation differential. During U.S. recessions, the average non-U.S. correlation is 69.5%. During expansions, the correlation is 17.9%.

CONCLUSIONS AND IMPLICATIONS

The globalization of investment portfolios is a clear trend in asset management. Investment managers base this structural shift in their portfolios on the potential for obtaining higher returns and reducing risk through greater portfolio diversification. We have shown, however, that it is more difficult than believed to escape the influence of U.S. capital markets and the U.S. business cycle.

Although most international cross-correlations are below 50%, there are significant linkages between U.S. equity market returns and foreign returns. Average returns are heavily tilted in the direction of U.S. returns. In down U.S. equity markets, volatility is higher, and the association between returns is higher, whether measured by covariance or correlation.

Our work shows that there is evidence that the U.S. economic cycle, and by association the world business cycle, has significant effects on world capital markets. Poor economic conditions in the U.S. cause uniformly poor foreign equity returns, higher volatility, and higher correlation of returns. This implies that the benefit of international diversification is lower when it is most needed.

Global investors must have a view on how to manage currency exposures. If the goal of international diversification is to reduce risk, then our results suggest that naive strategies such as currency overlays (where the investor hedges the foreign exchange component of the foreign equity return

outside the portfolio optimization) may *increase* risk. Both hedged international equity and fixed-income returns have greater correlations with the U.S. equity return. Furthermore, the correlation of hedged returns with the U.S. equity return is greater in recessions than the correlation of unhedged returns. These results suggest that overlays should be avoided.

Do world markets still serve as a hedge? The answer is affirmative. At the same time, our analysis provides powerful evidence that the hedging performance depends on the state of the U.S. equity market and economy. It is a mistake to use returns, volatilities, and correlations measured by averages, over many different market and economic states, in portfolio management. Our results also suggest that statistical forecasting methods for these portfolio inputs must include variables that proxy for the expected state of the economy.

ENDNOTES

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*The unconditional correlation is defined as

$$\rho_{ij,t} = \frac{\sum_{k=1}^{60} \left(r_{i,t+1-60} - \mu_{i,t}\right)\left(r_{j,t+1-60} - \mu_{j,t}\right)}{\sigma_{i,t}\sigma_{j,t}},$$

where μ_t represents the mean return over the past sixty months, and σ_t is the standard deviation estimated over the past sixty months. This measure is calculated with returns from time t to t – 59. It is often used as the forecast for time t + 1.

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