**CBOT® Dow Jones℠ Complex**



### The CBOT® Dow Jones Industrial Average℠ Futures and Futures Options

### Advanced Trading Strategies

# International Stock Index Spread Opportunities in Volatile Markets

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## Introduction

In a striking replay of October 1997, and October 1987 a decade earlier, international stock prices floundered in mid-August of 1998. The turbulence that swept through global financial markets in the ensuing months highlights once again their interdependence. The linkages between markets have tightened over the last 10 years and have tended to tighten further during financial crises, when volatility and bearish sentiment become endemic. The gradual convergence of equity markets has been reflected in an overall rise in stock index correlations, and correlations have climbed even higher during disorderly periods. This increase was very visible in the third quarter of 1998, when correlations between the DJIA℠ and the majority of European stock indexes spiked up by 10% to 20% from their levels in the previous two quarters.

Standard portfolio diversification (long in all securities) is notoriously less effective in a high- correlation environment. In particular, as shown by the debacle of last August, international diversification brings little relief when the world's stock markets are falling in unison. The positive side of this predicament is that intermarket spreading, simply a broader form of diversification, becomes more effective. An intermarket spread combines offsetting exposures in two stock markets, and a high correlation between the two implies the spread is much less volatile than outright exposures. Actively traded spreads-calendar spreads, the MOB, and the TED spreads-are based on high correlations between spread components. The rise in international stock index correlations is now generating similarly attractive spread opportunities. The most practical way to manage these spreads is to trade futures on the benchmarks. The performance of spreads of CBOT® DJIA℠ futures and futures on the DAX, FTSE, CAC, and EURO STOXX 50 during the third quarter of 1998 provides a good illustration of the benefits of this approach.

## Volatility, Correlations, and International Stock

## Volatility, Correlations, and International Stock Index Futures Spreads

The world's economies and equity markets have become more integrated, and this is reflected in higher correlations between national stock indexes. The trend is widely acknowledged for European indexes, but what is less acknowledged is that correlations between U.S. and many non-U.S. indexes have also increased. The long-term rise in international correlations is accentuated during bouts of volatility, the latest instance of which occurred in the third quarter of 1998. Starting at the end of July, stock prices began to plummet across the world's stock markets, implied volatilities reached 50% and above-levels not touched since 1987-and there were quantum jumps in international stock index correlations.

The conjunction of plunging prices, soaring volatility, and rising correlations was not coincidental. It is a typical configuration that has been discussed in a number of empirical papers. The relationship between volatility and returns is asymmetric: Volatility increases more when prices decrease than when they increase. This asymmetry has been linked to leverage, time-varying risk premiums, or common causal factors such as political uncertainty.

Common fundamental shocks are also the most likely reason that correlations increase during financial crises. A second reason that markets are more closely knit during bear than during bull phases is that contractions in liquidity and negative changes in market sentiment are especially contagious (two empirical studies of contagion effects are Odier and Solnick (1993) and Lin, Engle, and Ito (1994)). The stocks most impacted by these changes are the blue-chip stocks that constitute national stock benchmarks. This is seen in Table 1, which shows dramatically higher correlations between the DJIA℠ and European indexes for the third quarter of 1998. Table 1 also shows that there has been a steady increase in index correlations since 1993, and that the third quarter jump in correlations did not dissipate in the following quarter.

***Table 1***

Correlations Between Weekly Rates of Return DJIA℠ vs. International Blue-Chip Indexes

| | **1993** | **1994** | **1995** | **1996** | **1997** | **1998 QI-QII** | **1998 QIII** | **1998 QIV** |
|---|---|---|---|---|---|---|---|---|
| **DJIA℠/DAX** | 0.25 | 0.37 | 0.42 | 0.47 | 0.67 | 0.67 | **0.77** | **0.79** |
| **DJIA℠/CAC** | 0.35 | 0.44 | 0.47 | 0.49 | 0.60 | 0.60 | **0.81** | **0.70** |
| **DJIA℠/FTSE** | 0.35 | 0.49 | 0.56 | 0.46 | 0.65 | 0.65 | **0.88** | **0.74** |
| **DJIA℠/STOXX 50** | 0.37 | 0.56 | 0.54 | 0.52 | 0.41 | 0.60 | **0.55** | **0.75** |
| **DJIA℠/EURO STOXX 50** | 0.36 | 0.48 | 0.53 | 0.53 | 0.43 | 0.58 | **0.78** | **0.76** |
| **DJIA℠/NIKKEI** | 0.23 | 0.30 | 0.21 | 0.31 | 0.38 | 0.38 | **0.56** | **0.74** |
| **DJIA℠/HANG SENG** | 0.13 | 0.28 | 0.38 | 0.50 | 0.49 | 0.49 | **0.67** | **0.66** |

High equity correlations diminish the benefits of international diversification. Furthermore, the significantly higher correlations observed since August 1998 are likely to persist. Multiyear periods of high international correlations have recurred periodically. In addition, some of the factors currently driving correlations higher are long-term in nature. Money managers have therefore begun to ponder whether international diversification is worth the cost. Several recent empirical analyses of the issue conclude that the gains to diversification have decreased, but not that significantly. De Santis and Gerard estimate that the average gain from international diversification to a U.S. investor over the last two decades was 2.11%. Fund managers will nevertheless find that intermarket spreading is an effective complement to conventional diversification in the new international environment.

An intermarket spread consists of offsetting positions in two equity markets. Its purpose is to capitalize on their relative performance. For example, a spread of the DJIA℠ and the DAX measures the performance of blue-chip U.S. stocks relative to that of blue-chip German stocks. As mentioned earlier, the advantage of a spread is that it is considerably less risky than outright exposures if the correlation of the underlying markets is high.

Intermarket spreads can be traded directly with stocks, but it is preferable to trade stock index futures. There are stock index futures on all major broad-based world benchmarks. Indexation to these benchmarks is sufficient to reap the essential benefits of international diversification while avoiding the need to research individual foreign companies. The transaction efficiencies of stock index futures to manage an international portfolio of index exposures are well established. Stock index futures markets are more liquid than their stock counterparts. In particular, global average daily volume is 25% greater for stock index futures than for stocks. Futures also have lower transaction costs in the form of lower brokerage, tighter spreads, and smaller market impact costs. Estimates of the ratio of transaction costs for stock index futures versus the costs of an equivalent stock transaction range from about 7% for the U.K. to 17% in Hong Kong.

## Performance of International DJIA℠ Spreads Third Quarter of 1998

To demonstrate the benefits of spreading, we review the recent performance of spreads of CBOT® DJIA℠ futures against the major European and Asian stock index futures, specifically: DAX, CAC, FTSE, EURO STOXX 50, Nikkei 225, and Hang Seng futures. Performance is characterized by the average weekly performance of spread returns and by the time path of weekly spread returns.

**Spread Calibration**
Each spread is assembled from offsetting positions in two stock index contracts, and, since these contracts are denominated in different currencies, one or the other is converted at the relevant exchange rate. Consider, for example, a spread of CBOT® DJIA℠ futures and DAX futures with contract multipliers of $10 and DM100, respectively. If the price of Sep 1998 DAX futures is 5694, the price of Sep 1998 CBOT® DJIA℠ futures is 9024 and the exchange rate is 1.769 DM/$, the equilibrium spread ratio is 1 CBOT® DJIA℠ futures per .28 DAX futures (.28 = (9024 x 10 x 1.769)/(100 x 5694)). Given this ratio, the exposure of each leg is approximately $90,240, equivalently DM159,634. Spread ratios would be computed in the same way for European futures contracts redominated in Euros.

**Weekly Return Characteristics**

The rate of return of a CBOT® DJIA℠ futures spread is a risk premium equal to the return per currency unit of spread exposure. This return can be derived in any currency, but the two currencies corresponding to the two spread legs are the most natural. For example, the weekly rate of return of a long CBOT®DJIA℠ / short DAX spread can be expressed as the return per dollar of spread exposure ("dollar rate") or as the return per deutschemark of spread exposure. These two rates are equal to:

$$\$\ R_{DJIA/DAX} = [R_{DJIA} - R_{DAX}\ (1+RX)] \text{ or, DM } R_{DJIA/DAX} = [R_{DJIA}(1+1/R_X) - R_{DAX}]$$

where $R_{DJIA}$ and $R_{DAX}$ are weekly rates of return on the DJIA℠ and the DAX, and $R_X$ is the dollar / DM weekly rate of exchange.

The volatility of the DM $R_{DJIA/DAX}$ is:

$$SQRT\{?^2\ [R_{DJIA}(1+1/R_X)] + ?^2[R_{DAX}] - 2?\ X\ ?[R_{DJIA}(1+1/R_X)]\ X\ ?[R_{DAX}]\}$$

where $[R_{DJIA}\ (1+1/R_X)]$ and $[R_{DAX}]$ are historical volatilities of DJIA℠ and DAX weekly rates, with the DJIA℠ rate calculated deutschemarks,1 and r is the correlation between the two rates. The expression for the volatility of the dollar rate is completely analogous. The expression of the standard deviation shows explicitly the inverse relationship between correlation of components and spread volatility.

***Table 2***

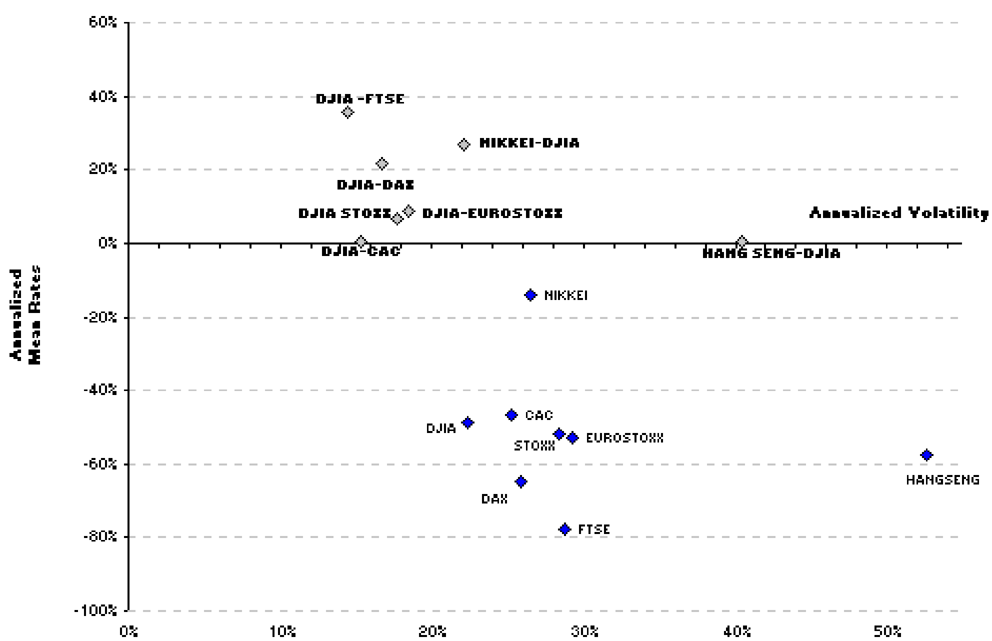
| | Weekly Rates Annualized Means | Weekly Rates Annualized Volatility |
|---|---|---|
| DJIA℠ | -48.88% | 22.35% |
| FTSE | -77.48% | 28.77% |
| DAX | -65.00% | 25.89% |
| EURO STOXX | -53.04% | 29.28% |
| STOXX 50 | 51.73% | 28.39% |
| NIKKEI | -14.04% | 26.46% |
| HANG SENG | -57.72% | 52.57% |
| CAC | -46.80% | 25.24% |
| **DJIA℠-CAC** | 0.52% | 15.36% |
| **DJIA℠-FTSE** | 35.88% | 14.42% |
| **DJIA℠-DAX** | 21.84% | 16.73% |
| **DJIA℠-EURO STOXX** | 8.84% | 18.46% |
| **DJIA℠-STOXX** | 6.76% | 17.74% |
| **NIKKEI-DJIA℠** | 27.04% | 22.14% |
| **HANG SENG-DJIA℠** | 0.52% | 40.45% |

The mean rate of the DJIA℠ /DAX spread shown on Chart 1 is the average value of DM RDJIA/DAX from June to September, and the spread volatility is value of DM RDJIA/DAX from June to September, and the spread volatility is the standard deviation of DM RDJIA/DAX. The other spreads are also expressed in nondollar currencies. When the same rates are computed from dollar exposures, the scatter plot turns out to be very similar. This is because currency risk was not a critical factor of performance over this period.

The effect of spreading on risk manifests itself in two ways. First, the average loss from being on the wrong side of a position-i.e., short when it should have been long and vice versa-is always substantially smaller for spreads than for individual indexes. For example, the mean weekly loss (annualized) of a long DJIA℠ position is 48.88% and it is 46.805 for the CAC, while a long CAC/short DJIA℠ spread loses only .52%. Second, spreads of well-correlated stock indexes are less volatile than the indexes. The most telling examples are spreads of the DJIA℠ against the FTSE, CAC, and DAX, which have the highest component correlations. The volatility of the DJIA℠/FTSE spread is 14.42%, that of the DJIA℠/CAC spread is 15.36%, and that of the DJIA℠/DAX spread is 16.73%. Index volatilities are 22.35% for the DJIA℠, 28.77% for the FTSE, 25.24% for the CAC, and 25.89% for the DAX.

Charts 2A - 2G show the paths of weekly spread returns and paths of index weekly returns. The directions of the spreads in these charts are the same as those in Chart 1 and are invariant through the whole period. The graphs show that the best spread opportunities emerged right around the time of the selloff and continued through September. All stock markets experienced abrupt fluctuations during these few weeks, but they were not all fluctuating at identical rates or on identical dates. These discrepancies magnified spread returns. Imperfect timing of spread direction would naturally still have caused losses, but the important point is that these losses would have been smaller than the losses on the indexes.

**CHART 1**
**GLOBAL STOCK INDEX FUTURES AND FUTURES SPREADS**
**Weekly Rates of Return, Early June - September '98 Expiration**




- - - FTSE WEEKLY RATE

**CHART 2 A**
**PERFORMANCE OF CBOT DJIA - FTSE 100 FUTURES SPREAD**
**June - September '98 Expiration**

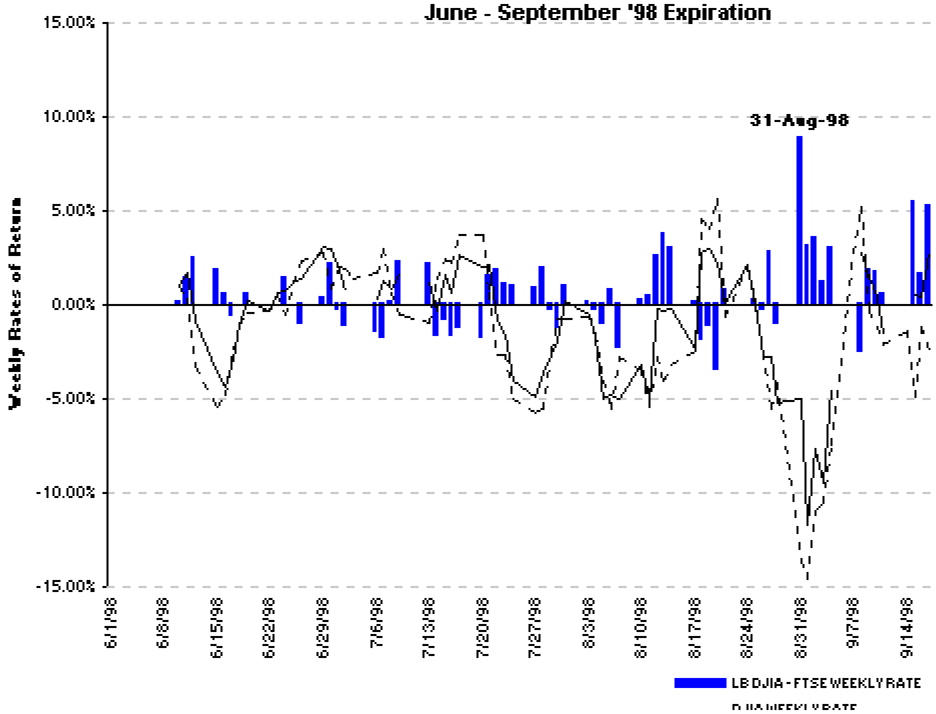
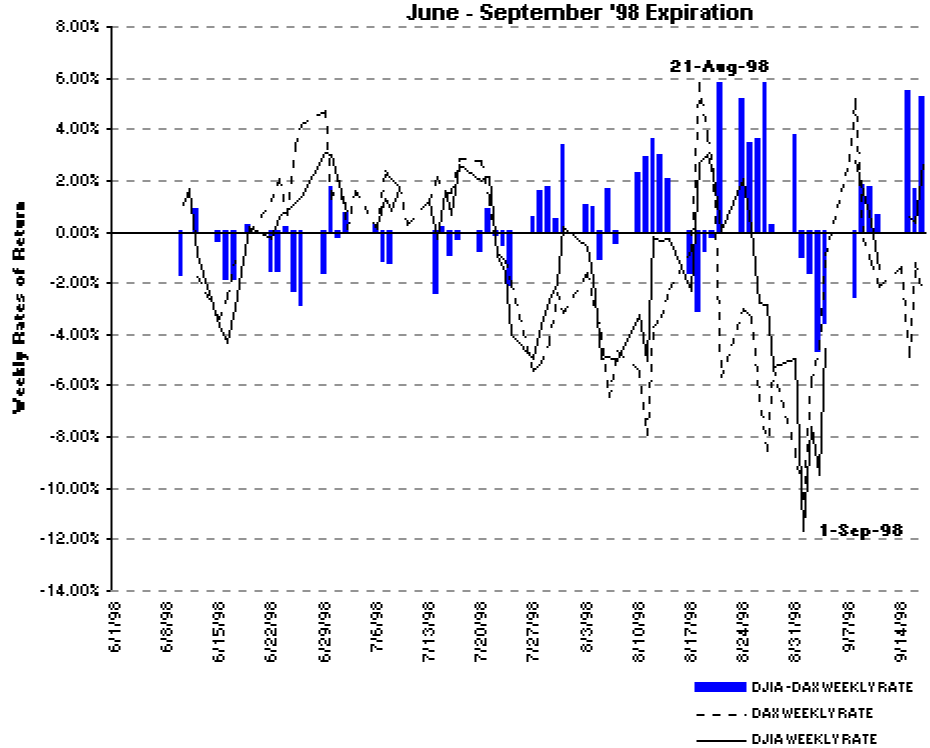



**CHART 2 B**
**PERFORMANCE OF CBOT DJIA - DAX FUTURES SPREAD**
**June - September '98 Expiration**



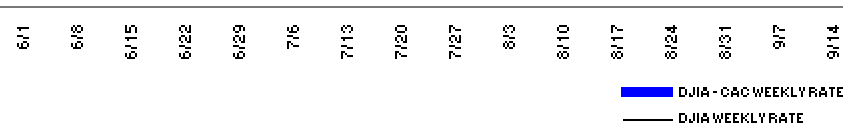



**CHART 2 C**
**PERFORMANCE OF DJIA - CAC FUTURES SPREAD**
**June - September '98 Expiration**

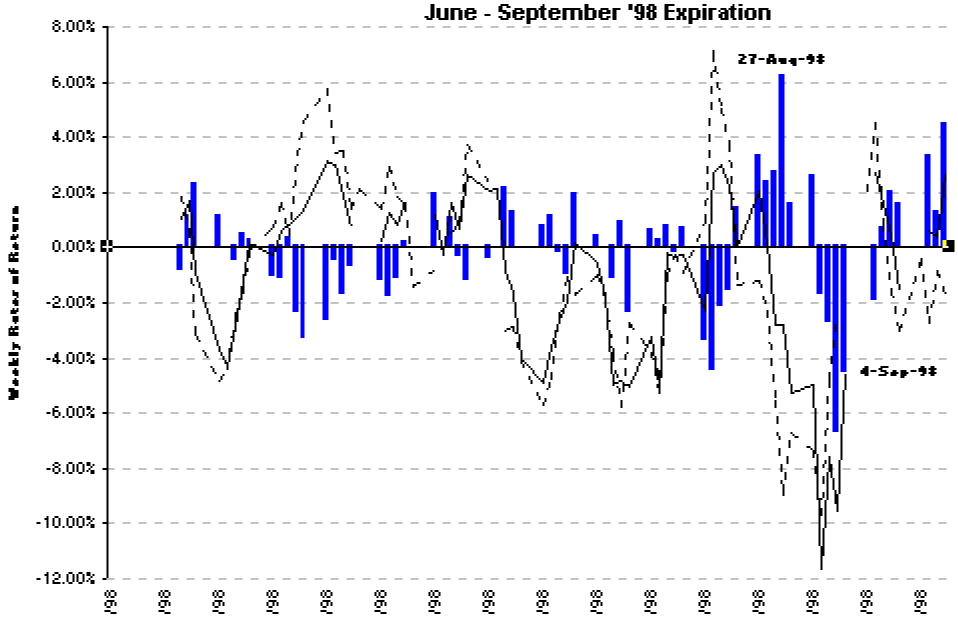
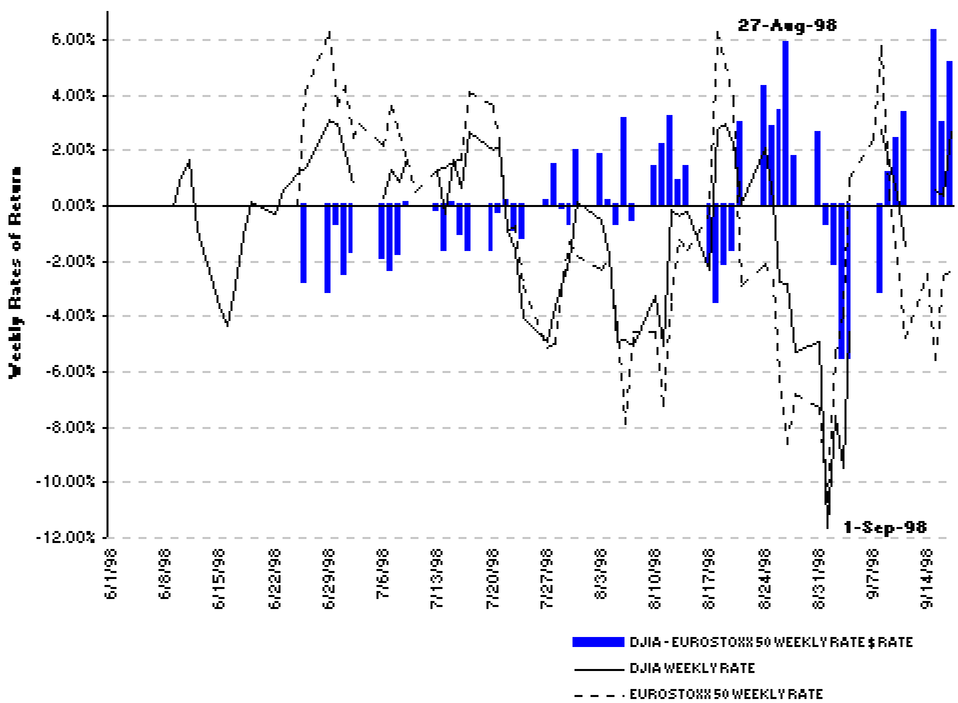



**CHART 2 D**
**PERFORMANCE OF CBOT DJIA- EUROSTOXX 50 FUTURES SPREAD**
**June - September '98 Expiration**



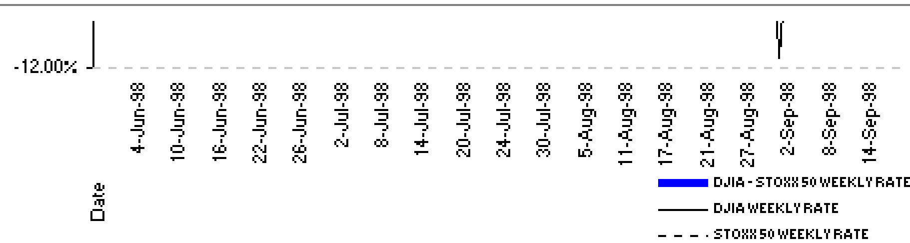



**CHART 2 E**
**PERFORMANCE OF CBOT DJIA - STOXX 50 FUTURES SPREAD**
**June - September Expiration**

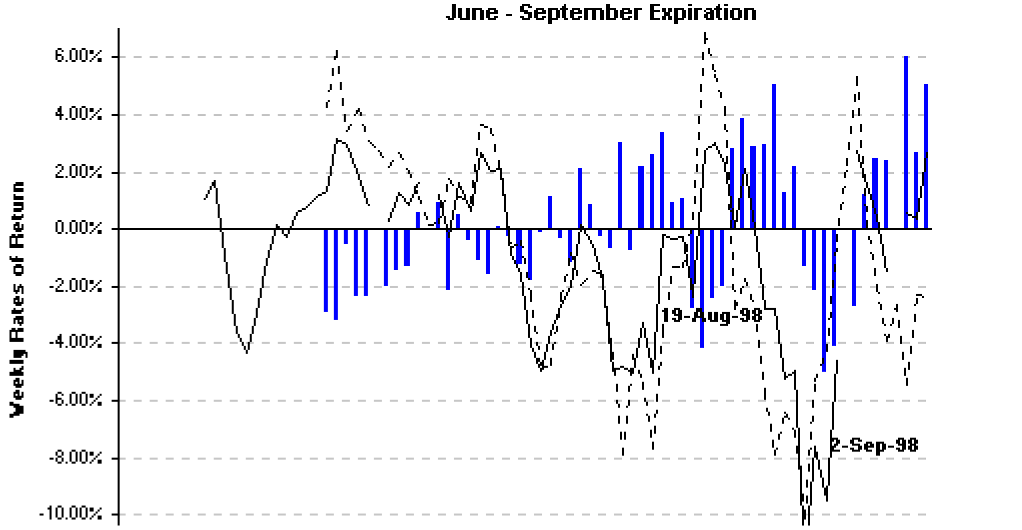
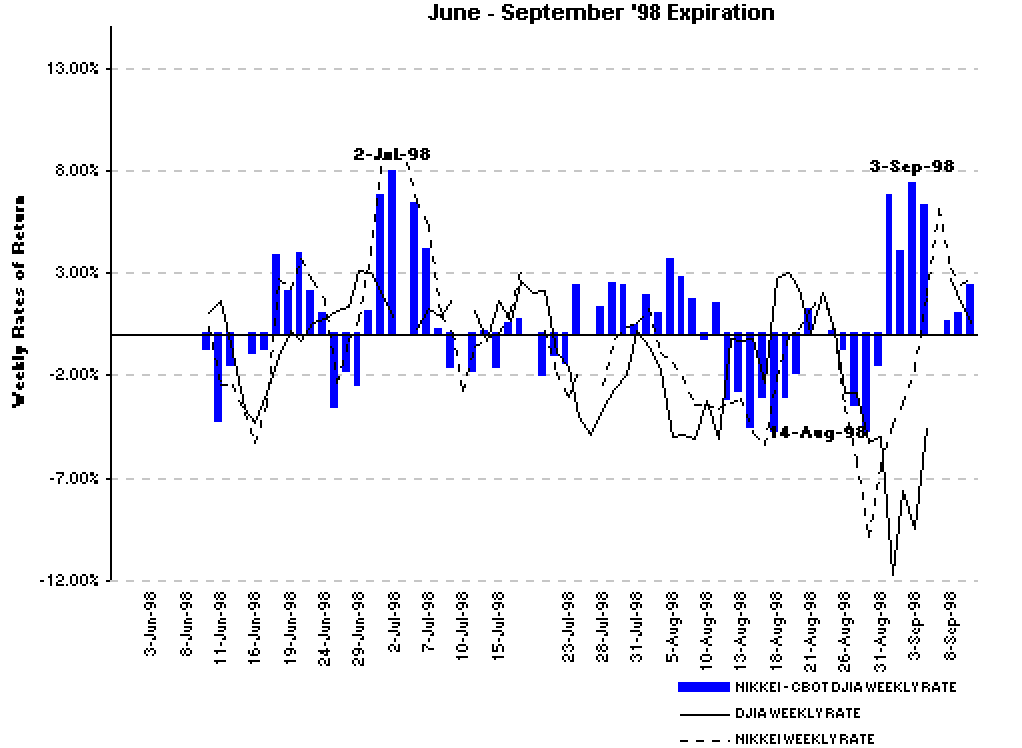
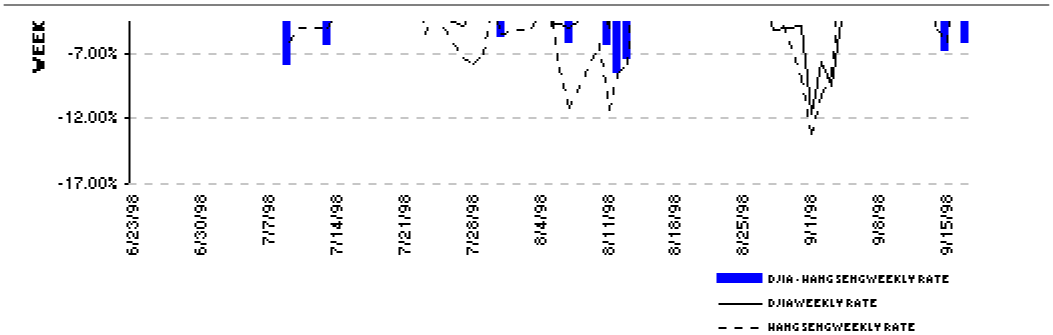
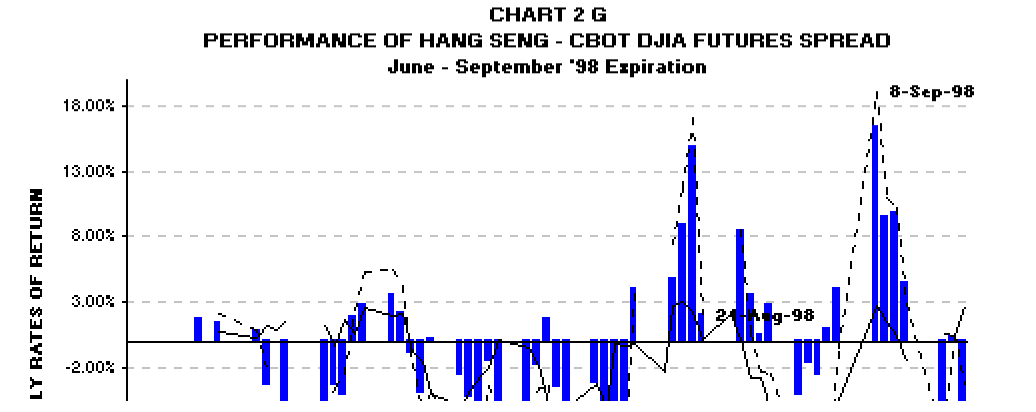



**CHART 2 F**
**PERFORMANCE OF NIKKEI - CBOT DJIA FUTURES SPREAD**
**June - September '98 Expiration**






**Conclusion**

Several factors point to the long-term appeal of international DJIA℠ futures spreads. First, the probability of new spurts of global volatility remains high, because the liquidity problems uncovered in October 1997 are far from resolved. Second, sharply higher index correlations may persist even if markets stay relatively stable, as they were in the fourth quarter of 1998. The major reason is that the arrival of the Euro is accelerating the transformation of European equity markets and lifting the remaining barriers to global portfolio management. This means markets will become even more integrated. Market analysts are predicting that the EMU will focus interest on large, liquid stocks- precisely the stocks most closely correlated with DJIA℠ stocks. In light of these factors, spreading CBOT® DJIA℠ futures against European blue-chip stocks will continue to be an attractive, less risky approach to international diversification.

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