MARKET SECTOR REACTIONS TO 9-11: AN EVENT STUDY

C. Pat Obi, Purdue University Calumet

ABSTRACT

This study presents an overview of how stocks believed to be most vulnerable to the 9-11 attacks reacted, in particular, in the pre-event period. The insider information theory about pre-knowledge of the attacks is carefully analyzed in both the airlines and the financial services sectors of the market. Standard event study methodologies are used to calculate abnormal returns before and after the attacks. Also, risk-adjusted returns are examined to determine whether investors achieved differential performance during the event period. Expectedly, significant negative excess returns occurred in the airlines and financial services sectors due to the incident. A subsequent reversal of excess returns indicates that markets may have overreacted to the attacks. Uncertainties in energy supply resulted in high but short-lived oil prices. Pre-event negative excess returns in airlines and financial stocks are suggestive of a trading pattern that may have been driven by expectation of an impending anomaly.

INTRODUCTION

The 9-11 attacks were a series of coordinated terror attacks in the United States on September 11, 2001. The attacks caused considerable disruptions to the U.S. economy as well as the financial market system. Following the attacks, the broad-based S&P500 index fell by more than 10 percent. The European markets suffered as well. In London, the FTSE 100 lost about six percent while the DAX in Frankfurt closed down 8.5 percent. Both the CAC 40 in Paris and the Swiss Market Index lost more than seven percent of their values. The attacks also revealed the vulnerability of the US financial infrastructure. The stock markets were closed for four days while bond trading was suspended for two. As well, there were significant disruptions in the clearing and settlement systems for government and many other financial assets. Investors seeking safe havens in a time of uncertainty bid up gold and crude oil prices.

It was also apparent that the nature of the attacks caused investors to permanently reassess their market risk perception. Graham and Harvey (2002) explain that the initial reaction of investors was to reduce profit projections by increasing the discount factor for future profits. Drakos (2004) and Straetmans et al (2003) agree, pointing out that total investment risk, in particular in the airline industry, rose substantially after the attacks. Ito and Lee (2005) note that the negative demand shock in the airline industry appeared to persist and could not easily be explained by economic or seasonal conditions.

Anecdotal evidence suggests that trading in the stocks of American Airlines (AMR) and United Airlines (UAL) rose markedly just before the attacks. According to the Bloomberg Financial News, shortly before 9-11, short put option positions in the stocks of Morgan Stanley Dean Witter and Merrill Lynch – both of which were housed in the World Trade Center – were more than 25 times their usual volume.[1] After the attacks, authorities in the US, Europe, and Japan launched an investigation to determine whether any of these trades were on account of the impending attacks. These investigations have so far proved inconclusive.[2]

LITERATURE

Most financial studies on 9-11 focus on market activity after the attacks as well as attempts by the Fed to stabilize the economy. Prior to September 11, 2001, all measures of economic activity suggested that the third quarter of 2001 would produce a negative GDP. Sure enough, when the third quarter numbers came to light, real GDP had contracted -1.4 percent. With consumer confidence at a three-year low, the 2001 recession was well underway.

In a post 9-11 survey of active investors, Glaser and Weber (2003) find that returns forecasts were significantly higher than realized returns as investors believed that markets had overreacted to the attacks. They also discover that volatility forecasts were higher in post 9-11. In a related study, Graham and Harvey (2002) find that investor estimate of the one-year risk premium fell sharply after 9-11. This occurred because volatility forecasts rose as investors grew more wary of the likelihood of more attacks.

Carter and Simkins (2004) present evidence of short-term negative excess returns in the airline industry. Their studies also show that while being concerned about the increased likelihood of financial distress, investors were able to separate airlines that are financially sound from those are financially distressed. In a study of option market activity for AMR and UAL prior to 9-11, Poteshman (2006) finds that while volume ratio statistics were at their typical levels, the long put volume indicator was unusually high. He then concludes that such behavior is consistent with a condition where informed investors trade in advance of a known event.

The efforts by the Fed to mitigate the strain on the payment system are addressed by Cumming (2002), Williamson (2004), and Strauss (2001). This system is the network of financial institutions that ensures the timely settlement of securities transactions. These studies observe that the Fed's efforts to quickly redistribute reserves within the financial system, after the attacks, helped ease the intensity of market disruptions as well as create the impetus for real growth in the GDP.

The risk effect of 9-11 on airline stocks in Europe and the United States is discussed by Drakos (2004) and Straetmans et al (2003). These studies find that both systematic and idiosyncratic risk increased considerably after the attacks. Unfortunately, the latter study makes the nebulous conclusion that the potential for domestic portfolio diversification during crisis periods, when diversification is most needed, decreased compared to pre 9-11 period. Since domestic diversification is typically designed to minimize idiosyncratic risk, it is unclear as to what good such manner of diversification would have done in the face of such a major systematic shock.

In a study of foreign exchange and stock market reactions to terror, Eldor and Melnik (2004) find that market sensitivity to terror does not necessarily diminish with time much though as the market remains efficient. In a similar finding, Chen and Siems (2004) conclude that U.S. capital markets are actually more resilient than ever before. They show that U.S. markets do in fact recover sooner from terror attacks than other major capital markets.

This study is an inquiry about the performance of the designated market sectors before and after 9-11. The market sectors investigated are airlines, financial services, and energy. The evaluation is especially concerned with the level of market efficiency in the pre-event period. Pre-event abnormal price behavior is the basis for verifying possible pre-knowledge of the attacks. Market efficiency in the semi-strong form is evaluated based on post-event abnormal returns. The response of the all-important energy market to the attacks is also addressed. The rest of the paper is organized as follows: data and methodology are described in the next section, followed by a presentation of empirical results. Study conclusions are presented in the last section.

DATA AND METHODOLOGY

The industry groups and futures contracts from which daily price data are obtained for this study are listed in Table 1.

Table 1: Data Sources and Description

Industry	Sample Size of Firms	Geographic Region
Airlines	21	U.S., Europe
Financial services	47	U.S., Europe
Energy	44	U.S., Europe
Crude oil spot	NA	U.S.
Crude oil – 1month futures	NA	U.S.
Crude oil – 4-month futures	NA	U.S.

The airlines and financial services sectors contain all the stocks named by the U.S. regulatory authorities as possible culprits of 9-11 speculative trading. Sample period for the estimation data is November 1996 to May 2001. Altogether, 1142 daily price data are used to estimate the model parameters. Stock price and index data are obtained from CRSP tapes and are adjusted for dividends and stock splits. Crude oil spot and futures data are for the West Texas Intermediate and are obtained from the data base of the Energy Information Administration. Finally, interest rate data are obtained from the Federal Reserve Bank of Saint Louis data bank.

MOTIVATION

The semi-strong form of the efficient markets hypothesis (EMH) implies that all publicly available information is reflected in the market value of a stock. This also suggests that prices respond quickly and accurately to emerging information, making it difficult to achieve abnormal gains in the market. The implication of the EMH is that only information that is not publicly available can benefit investors that seek abnormal gains on their investments. All other information is accounted for in the asset price and, regardless of the amount of fundamental and technical analysis one performs, excess returns cannot be sustained in the long haul (Peterson, 1989 and Fama, 1998).

Occurrence of abnormal returns in the immediate period after the attacks does not necessarily violate the semi-strong form of the EMH. In fact, it is the notion of the EMH that such unanticipated events should bear their full impact on share values. However, when abnormal returns persist long after an event, or when abnormal returns occur prior to the event, it becomes difficult to sustain the EMH. The former condition suggests that investors can earn abnormal returns even after the full effect of the event is known. The latter case suggests that insider information may have created opportunities for abnormal gains in the market. Event studies such as this are generally designed to determine the presence of any or both of such abnormal conditions.

Measuring Excess Returns

Using the risk adjusted returns (RAR) model, abnormal return for each security j is calculated based on the following stochastic process:

$$AR_{j,t} = R_{j,t} - (\hat{\alpha}_j + \hat{\beta}_j R_{M,t}), \quad (1)$$

where

$AR_{j,t}$	=	Abnormal return for stock j at time t
$R_{j,t}$	=	Actual return for stock j at time t
$R_{M,t}$	=	Return on the market at time t, as proxied by the S&P500 value-weighted index
$\hat{\alpha}_j$	=	Least squares estimate of the intercept of the market model
$\hat{\beta}_j$	=	Least squares estimate of the slope coefficient of the market model

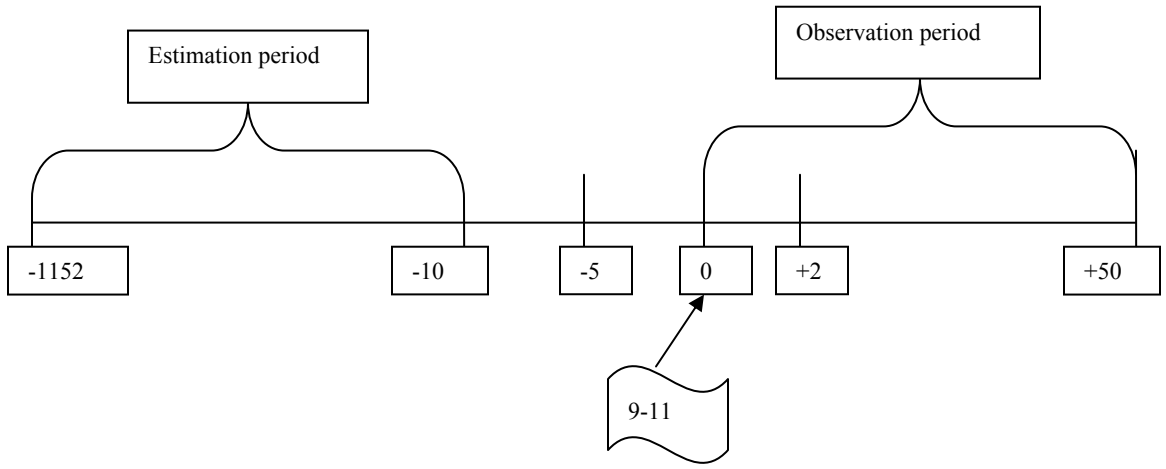
The parameters, α_j and β_j, are estimated from the following market model:

$$R_{j,t} = \alpha_j + \beta_j R_{M,t} + \varepsilon_{j,t}, \quad (2)$$

where ε_t is the residual term, with the following usual properties:

$$E(\varepsilon_{j,t}) = 0 \quad \text{and} \quad Var(\varepsilon_{j,t}) = \sigma^2\varepsilon_{j,}$$

Most notably, $\sigma^2\varepsilon_{j,t}$ is the residual variance (mean square error) of the regression.
Model parameters are estimated from the 1142-day period prior to the observation period of the study (day t = -1152 to day t = -10). To avoid confounding events leading up to the observation period, days t = -9 to t = -5 are excluded from the analysis. Pre-event period is the five trading days before 9-11. The event study timeline is as follows:



Measuring Portfolio Performance

One way to determine if the overreaction hypothesis is supported by the excessive price behavior around 9-11 is to discount excess returns by the size of investment risk.[3] The Sharpe Performance Index (SPI) is an appropriate performance measure when total portfolio risk is applied. Excess return is calculated as the difference between the return on the portfolio and the risk free interest rate over the same period. This difference is then discounted by the portfolio's standard deviation. Using sample estimates:

$$\text{SPI} = \frac{\bar{r}_P - \bar{r}_F}{s_P}, \quad (3)$$

where

$\bar{r}_P$ = Average daily return on the portfolio of stocks during the observation period

$\bar{r}_F$ = Interest rate on risk-free bonds during the observation period, proxied by the yield on 10-year Treasury bonds

$\bar{r}_M$ = Average return on a well diversified market index, proxied by the S&P 500.

s_P = Sample standard deviation of the daily return on the portfolio during the observation period

A SPI value of greater than 1 indicates a superior performance relative to the level of risk taken to earn that excess return. An index value of less than 1 indicates that risk is disproportionate to the excess return earned (Daniel, Hirshliefer, and Subramanyam, 1998).

EMPIRICAL RESULTS

Event study results, showing cumulative average abnormal returns (CAAR) for each of the three equity sectors, are summarized in Table 2. Graphs of average abnormal returns and cumulative average abnormal returns are presented in Figures 1 to 6. A summary of abnormal returns for crude oil futures are presented in Table 3. Table 4 contains results of portfolio performance. The following results are presented with respect to their implications for the efficient markets hypothesis.

Table 2: Market Sector Abnormal Returns Around 9-11

Panel A. Airlines Stocks (n = 21)		
Event Time +	**Cumulative Abnormal Return**	**t Statistic**
t = 1	-0.3726 ***	-24.0417
t = -1	-0.0131	-0.8481
t = -5 to t = -1	-0.0666 *	-1.9222
t = 2 to t = 50	0.2630 **	2.4243
Panel B. Financial Services Stocks (n = 47)		
Event Time +	**Cumulative Abnormal Return**	**t Statistic**
t = 1	-0.0427 ***	-3.8279
t = -1	0.0024	0.2145
t = -5 to t = -1	-0.0376	-1.5081
t = 2 to t = 50	0.0588	0.7535
Panel C. Oil Stocks (n = 44)		
Event Time +	**Cumulative Abnormal Return**	**t Statistic**
t = 1	-0.0202	-1.3670
t = -1	-0.0004	-0.0255
t = -5 to t = -1	0.0104	0.3155
t = 2 to t = 50	-0.0630	-0.6099

***Significant at $\alpha = 0.01$ level ** Significant at $\alpha = 0.05$ level * Significant at $\alpha = 0.10$ level

\+ Day 0 (September 11, 2001): markets yet to open when the attacks occurred at 8:46 AM local time

Event Day Results

The 9-11 attacks occurred prior to the start of trading in the United States. The massive destruction forced the markets to remain closed until September 17, 2001. Consequently, the primary day of market impact was September 17th (day t=1). As expected, for all equity sectors, 9-11 was associated with significant negative abnormal returns on the first trading day after the attacks. The wealth loss in the airlines sector was most severe, with a CAAR return of -37.3 percent; it was -4.3 percent for the financial services sector. These abnormal returns are significant at the 0.01 level. Results are presented in Panels A and B of Table 2 as well as in Figures 1 to 4.

Figure 1: 9-11 Abnormal Returns: Airlines

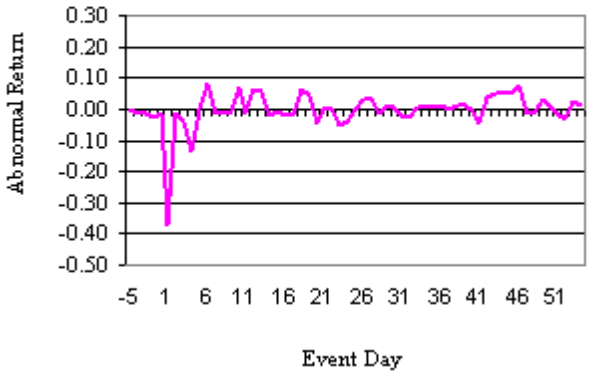


Figure 2: 9-11 Cumulative Average Abnormal Returns: Airlines

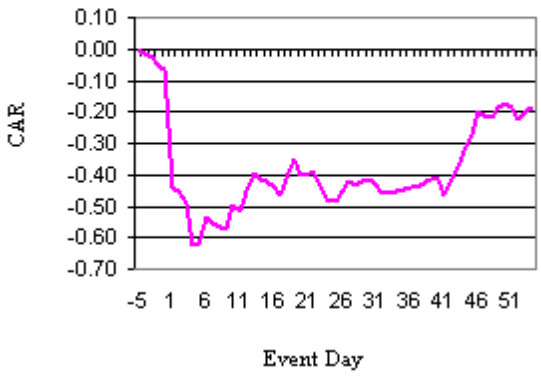


Figure 3: 9-11 Abnormal Returns: Financial Services

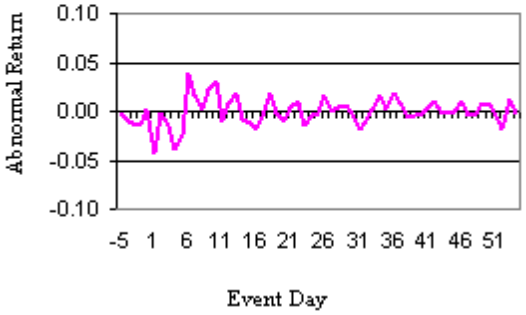
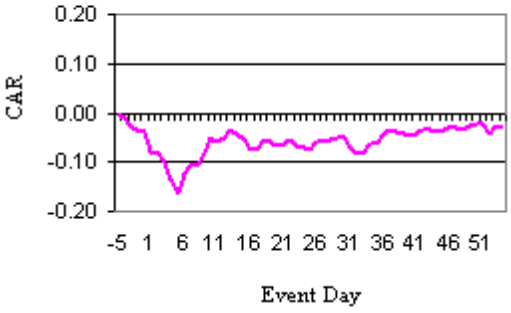


Figure 4: 9-11 Cumultative Average Abnormal Returns: Financial Services



Energy stocks suffered minimal loss on day t=1 as shown in Panel C of Table 2. Cumulative average abnormal return to shareholders was only -2.02 percent, which is not statistically significant. However, the subsequent trend in daily abnormal returns is perhaps more striking. Figure 5 indicates that abnormal returns decreased gradually but persistently to about -5 percent on day t=3. Thereafter, cumulative abnormal returns rose steadily until about day t=18 when the market stabilized. The latter evidence is shown in Figure 6. Why the energy market exhibited this sluggish trend is uncertain. However, it is well documented that crude oil price reacts primarily to unsystematic factors such as market speculation, Middle East conflicts, and production decisions by the Organization of the Petroleum Exporting

Countries (OPEC). When these factors suggest supply disruptions, energy prices tend to rise. The reverse occurs when a supply increase is anticipated (Obi, 1989).

Figure 5: 9-11 Abnormal Returns: Energy

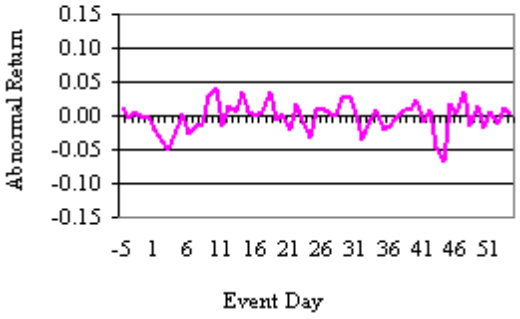


Figure 6: 9-11 Cumulative Average Abnormal Returns: Energy

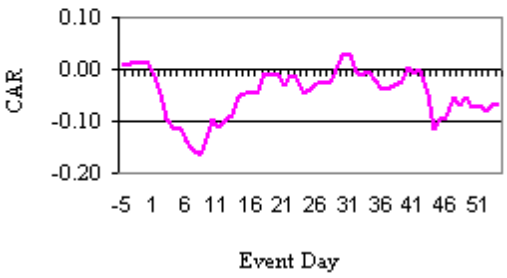


Table 3 presents abnormal returns for crude oil spot as well as 1-month and 4-month crude oil futures contracts. For all maturities, 9-11 was actually associated with positive abnormal returns of about 4.2 percent on day t=1. It is noteworthy that while abnormal returns for all contracts were about the same, only the abnormal return for the 4-month contract is significant at the 0.05 level. This suggests lower price uncertainty for the longer-term contract as speculators apparently factored in long-run market stability in crude oil supply. Event day positive abnormal returns in the oil market also reinforce the notion that oil prices react mostly to factors that are endogenous to the industry in addition to providing investors with safe haven in times of uncertainty.

Table 3: Abnormal Returns of Crude Oil Contracts around 9-11

Event Time	**Abnormal Returns**			**t Statistics**		
	Spot	**1-Month Futures**	**4-Month Futures**	**Spot**	**1-Month Futures**	**4-Month Futures**
t = 1	0.0421	0.0421	0.0420 **	1.6136	1.7053	2.3457
t = -1	-0.0124	-0.0148	-0.0102	-0.4755	-0.6006	-0.5683
t = -5 to t = -1	0.0346	0.0134	0.0171	0.5940	0.2424	0.4279
t = 2 to t = 50	-0.3759 *	-0.3785*	-0.3662 **	-2.0606	-2.1881	-2.9229

*** Significant at $\alpha = 0.01$ level
** Significant at $\alpha = 0.05$ level
* Significant at $\alpha = 0.01$ level

Information Leakage Theory

Evidence of illegal trading with insider information is based on the direction of pre-event abnormal returns. In the absence of any informational leakage, abnormal returns should not be significantly different from zero until the event day. If the market is strong-form efficient and if information related to 9-11 leaked out before hand, there should be a declining trend in cumulative abnormal returns prior to this day. In the circumstance, the substantial decline in abnormal returns on September 17th should only reflect the response of those stocks for which the event was either not anticipated at all or not fully anticipated prior to the event day.

The five-day pre-event CAAR for the three equity sectors are shown on Table 2 (t=-5 to t=-1). Results are mixed. For the airline industry in Panel A, the five-day CAAR is -6.67 percent, which is significantly different from zero at the 0.10 level. Although the pre-event CAAR for the financial services sector is also negative at -3.76 percent, this value is not significant at any conventional level. For the energy equity sector, pre-event CAAR is actually positive but not significant. There is no statistical evidence that pre-event abnormal returns in crude oil futures followed any distinct pattern. Figures 2 and 4 show that the CAAR for both the airline and financial stocks was on a down trend prior to event day. Since fully anticipated events result in maximum abnormal returns prior to event day, it is arguable as to whether 9-11 was in fact partly anticipated prior to the day.

Market Efficiency in the Semi-Strong Form

If the market is semistrong-form efficient, the CAAR should be significant only on the day of the event day or as it were, the first trading day after 9-11. The level of CAAR should not change afterward. If the negative reaction to 9-11 was completed by the first trading day after the attacks, and if the firms in the sample have nothing else in common thereafter, firm-specific abnormal returns should cancel out across the stocks in the portfolio and the CAAR will not change markedly from day to day thereafter.

The last part of the results in Table 2 shows the post-event CAAR for the 50 trading days after 9-11. Post-event CAAR for airline stocks is positive at 26.3 percent. This result is significant at the 0.05 level. Figure 1 shows that the increase in abnormal returns for airline stocks occurred on about the 5^{th} and 41^{st} trading days after 9-11. None of the other equity markets exhibited any significant post-event abnormal trend at least up to about the 36^{th} day, more than a month after the incident. The positive post-event excess return for the airline industry appears to substantiate the finding by Glaser and Weber (2003) that investor returns forecast after 9-11 rose substantially in the apparent belief that financial markets overreacted to the attacks.

Post-event abnormal returns for both the energy equity and commodities markets were negative. However, only cumulative abnormal returns in the commodities market are statistically significant. For example, post-event cumulative abnormal return for 4-month futures was -36.62 percent, which is significantly different from zero at the 0.05 level. This outcome might have been in response to announcements by leading OPEC countries that crude oil supply would be uninterrupted even as the U.S. was set to fight the war on terrorism.

In general, the equity market post-event performance is consistent with an efficient capital market in the semi-strong form. However, the behavior of airline stocks in post-event time appears to run contrary to this notion. This view is reinforced by the overreaction argument alluded to in Glaser and Weber (2003) as well as in Carter and Simkins (2004). Both of these studies suggest that post 9-11 returns forecast by investors was higher than realized returns.

Analysis of Portfolio Performance

Risk-adjusted portfolio performance is analyzed using the Sharpe Performance Index (SPI). Superior performance is achieved if SPI is greater than one. This metric is particularly useful in analyzing the quality of total portfolio performance since excess returns are discounted by total portfolio risk (measured by the standard deviation of returns). Thus, any benefits of portfolio diversification are reflected in the index value; the higher the index value – for indexes greater than one – the more superior the portfolio performance.

Results of the SPI are presented in Table 4 for each of the three equity sectors. None of the SPI values show superior portfolio performance. In fact, for the airlines and financial services portfolios, pre-event

SPI is significantly negative. This suggests gross underperformance compared to what investors could have earned on a riskfree security. While not negative, pre-event SPI for the oil portfolio is less than 1, which also suggests that oil stocks did not outperform the lowest yielding financial asset.

Table 4: Risk-Adjusted Portfolio Performance Around 9-11

Panel A. Airlines Sector			
	Post-event	**Day t=2; t=6**	**pre-event**
SPI	0.3541	-1.2130	-0.8150 ***
std err	0.3514	2.2683	0.2503
P-value	> 0.10	> 0.10	< 0.01
Panel B. Financial Services Sector			
	Post-event	**Day t=2; t=6**	**pre-event**
SPI	0.1326	-0.7269	-0.6268 **
std err	0.1745	1.1799	0.2957
P-value	> 0.10	> 0.10	< 0.05
Panel C. Energy Sector			
	Post-event	**Day t=2; t=6**	**pre-event**
SPI	-0.0336	-1.6991**	0.1779
std err	0.2161	0.5881	0.1931
P-value	> 0.10	< 0.05	> 0.10

*** Significant at $\alpha = 0.01$ level
** Significant at $\alpha = 0.05$ level
* Significant at $\alpha = 0.01$ level

In post-event time, none of the equity portfolios showed superior performance on a risk-adjusted basis. This means that positive gains from market overreactions to 9-11 were, on average, insignificant. This is also true in the immediate five-day vicinity after the attacks, when, perhaps the fear of further attacks was still evident, judging by the negative index values.

CONCLUSIONS

Three sectors of the equity market believed to be most vulnerable to 9-11 are analyzed for their reaction to this event. The sectors are airlines, financial services, and energy. Market speculation in the energy market is observed from the price behavior of crude oil futures contracts. Consistent with the insider information theory, pre-event negative excess returns in the airlines and financial services sectors indicate that the market might have suspected the impending attacks. The same is not true however for the energy sector where abnormal returns over the entire observation period are insignificant. Following the attacks, market prices seemed to adjust upwards which provided investors with positive abnormal returns. Post event gains were more pronounced in the airlines sector where the negative impact of the attacks was most severe.

Initial reaction to the event in the crude oil futures market was actually positive although somewhat muted for the near-term contracts. Positive abnormal returns in crude oil futures are understandable since investors with long positions make money on negative news.

Tests of portfolio performance using the Sharpe Performance Index showed that all three equity portfolios underperformed a riskfree asset in post-event time. Unfortunately, the bounce-back that occurred in the weeks after the incident did little to provide investors with superior performance beyond what they could have earned in low yielding Treasury securities.

In general, except for the idiosyncratic behavior of oil futures, post 9-11 performance revealed the characteristics of a sophisticated market structure. Pre-event and event-day anomalies did not persist in the weeks that followed the incident. Notwithstanding, the notion of market efficiency in the semi-strong form could not be upheld for the airlines sector where post 9-11 fever continued to grip the industry as investors weighed the possibility of further attacks as well as the huge fall off in airline passengers.

FOOTNOTES

1. Mathewson and Michael Nol, "U.S., Germany, Japan Investigate Unusual Trading Before Attack" Bloomberg Financial News, September 18, 2001.

2. Eberhart (2002) reports that the SEC list contained the following airline and financial services stocks: American Express, Bank of America, Bank of New York, Bank One, Citigroup, Continental, Deutsche Bank, General Motors, Lockheed Martin, Lehman Brothers, Lone Star Technologies, John Hancock, Merryl Lynch, MetLife, Morgan Stanley, Northwest, Raytheon, Southwest, USAirways, and W.R. Grace.

3. In general, the hypothesis on market reaction is in three forms: (i) Overreaction hypothesis, which states that extreme one-day price movements will be followed by significant movements in the opposite direction (ii) Under-reaction hypothesis, which argues that extreme one-day movements in stock prices will be followed by additional movements in the same direction, and (iii) Efficient markets hypothesis, which posits that extreme one-day movements in stock prices will not be followed by significant price movements up or down. Original insight is provided in William F. Sharpe, "Mutual Fund Performance," Journal of Business, Vol. 39, No. 1, Part 2, January 1966.

REFERENCES

Carter, David, and Betty J. Simkins (2004). "The Market's Reaction to Unexpected Catastrophic Events: The Case of Airline Stock Returns and the September 11th Attacks," Quarterly Review of Economics and Finance, Vol. 44, pp. 539-558.

Chen, Andrew H. and Thomas F. Siems (2004). "The Effects of Terrorism on Global Markets," European Journal of Political Economy, Vol. 20, June, pp. 349-366.

Cumming, Christine M. (2002). "September 11 and the U.S. Payment System," Finance and Development, Vol. 39, Number 1, pp. 1-7.

Daniel, Kent, David Hirshliefer, and Avanidhar Subramanyam (1998). "Investor Psychology and Security Market Under- and Overreactions," Journal of Finance, Vol. 53, pp. 1839-1885.

Drakos, Konstantinos (2004). "Terrorism-Induced Structural Shifts in Financial Risk: Airline Stocks in the Aftermath of the September 11th Terror Attacks," European Journal of Political Economy, Vol. 20, June, pp. 435-446.

Eberhart, Dave (2002). "Still Silence From 9-11 Stock Speculation Probe", NewsMax, June 3 http://www.newsmax.com/archives/articles/2002/6/2/62018.shtml

Eldor, Rafi, and Rafi Melnik (2004). "Financial Markets and Terrorism," European Journal of Political Economy, Vol. 20, June, pp. 367-386.

Fama, Eugene F. (1998). "Market Efficiency, Long-Term Returns and Behavioral Finance," Journal of Financial Economics, Vol. 49, pp. 283-306.

Glaser, Markus and Martin Weber (2003). "September 11 and Stock Return Expectations of Individual Investors," Working Paper, University of Mannheim, September 2003.

Graham, John R. and Campbell R. Harvey (2002). "Expectations of Equity Risk Premia, Volatility, and Asymmetry," Working Paper, Duke University.

Ito, Harumi and Darin Lee (2005). "Assessing the Impact of the September 11 Terrorist Attacks on U.S. Airline Demand," Journal of Economics and Business, Vol. 57, Issue 1, January-February, pp. 75-95.

Obi, C.P. (1989). "OPEC Meetings and Capital Market Reactions: Empirical Tests and Essays on Oil Price Volatility and Returns Behavior in the Commodity Market for Crude," Ph.D. dissertation, The University of Mississippi.

Peterson, Pamela P. (1989). "Event Studies: A Review of Issues and Methodology," Quarterly Journal of Business and Economics, Vol. 28, Summer, pp. 36-66.

Poteshman, Allen M. (2006). "Unusual Option Market Activity and the Terrorist Attacks of September 11, 2001," Journal of Business**,** July, Vol. 79, no. 4

Straetmans, Stefan T.M., Willem F.C. Verschoor, and Christian C.P. Wolff (2003). "Extreme U.S. Stock Market Fluctuations in the Wake of 9/11," Working Paper, Limburg Institute of Financial Economics, Maastricht University, March, pp. 1-27.

Strauss, Hubert (2001). "Assessing the Effects of the Terrorist Attacks on the U.S. Economy," Kiel Working Paper No. 1077, Kiel Institute of World Economics, Kiel, Germany.

Williamson, Stephen D. (2004). "Comment on Payment System Disruptions and the Federal Reserve Following September 11, 2001," Journal of Monetary Economics, July, Vol. 51, pp. 967-970.

BIOGRAPHY

Pat Obi is on the faculty of Purdue University Calumet as professor of finance. He received his Ph.D. in Finance from the University of Mississippi in 1989. He teaches MBA-level courses in corporate finance and econometrics. Dr. Obi's research is primarily in energy trading and international finance. He consults extensively for business and industry and is widely published in various academic journals. He is the author of Basics of Business Finance, a text published in the Lithuanian language.