War And Peace: The Reaction Of Defense Stocks

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Abstract

In this paper we examine the response of a portfolio of defense contractors to war- and peace-related events. An event-study methodology is employed, and GARCH estimates of abnormal returns suggest that on balance the defense portfolio responds positively to war-related announcements and negatively to peace-related announcements. A cross-sectional analysis of the abnormal returns to firms in the Gulf War indicates that larger abnormal returns are associated with R&D intensive firms in concentrated industries, while lower abnormal returns are associated with firms that commit to above-average levels of capital expenditures.

Introduction

The role of news as a determinant of stock returns has been the subject of considerable interest because the efficient market hypothesis assumes that stock returns fully reflect all available information and adjust immediately to the arrival of new information. However, a number of studies have suggested that the variation in stock and other prices cannot be wholly explained by the arrival of new information (Roll (1984) Roll (1988) Shiller (1981)).

A very few studies have attempted to directly analyze the effects of political events on aggregate stock prices (Niederhoffer (1971) Reilly and Drzycimski (1973) Cutler, Poterba and Summers (1989) Kim and Mei (1995). The results have been mixed. While the earlier studies concluded that world events do indeed affect the stock market, Cutler et. al. conclude that publicly available news can explain less than half of the variation in US stock prices. More recently, Kim and Mei

find that Hong Kong stock markets do respond to political events.

These studies typically examine a wide variety of news events, ranging from wars to presidential illnesses, and their effects on aggregate stock prices. They therefore do not account for the possibility that different industries might respond differently to the same news. One obvious example is the response to war news. While it is possible that wars reduce general confidence levels and therefore negatively affect the stock market as a whole, they may also positively affect the share prices of companies that supply war-related materials.

A few studies have in fact examined the role of wars or war-related events in determining the share prices of defense contractors (Billingsley et. al. (1987), McDonald and Kendall (1994)). Both of these studies conclude that war-related events have significant positive effects on the stock prices of defense industry firms. Billingsley et. al. also find that the same events which positively af-

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fect defense firms negatively affect the stock market as a whole.

This study extends previous research on the response of defense industry firms in a number of ways. Like previous studies, we use an event study methodology to examine the response of defense contractors to relevant announcements. However, we employ a larger sample (over 60 firms) to construct our defense portfolio and we employ a more appropriate method (GARCH) for estimating abnormal returns.

Most importantly, we extend the range of announcements considered. In addition to war, we consider peace; and unlike previous studies, we include a variety of announcements surrounding a major event, not just the event itself. If defense shares respond positively to war, as previous studies have found, then they should also respond negatively to peace. In addition, if markets are in fact efficient they should also respond to various announcements both prior and subsequent to the initial major event. Thus we more fully examine the response of defense industry stocks to a range of relevant announcements. Finally, we attempt to explain the observed abnormal returns for the most recent event (the Gulf War) using a cross section of firm-specific information.

Research Design

We apply an event study methodology to test the response of defense industry stocks to war- and peace-related news. We are therefore examining the market response to new information, specifically the response to events that alter the perceived probability that war will break out, continue or cease. In general, we expect that news which announces a war, increases the probability that war will break out, or increases the probability that an existing conflict will escalate, will be associated with an appreciation of defense industry stock prices. Previous studies (Billingsley et. al.(1987), McDonald and Kendall (1994)) have indicated that this is the case, at least for the outbreak of wars. For lack of a better term, we characterize these as 'positive' events. However, we also include an-

nouncements that reduce the probability that the war will continue, or that announce its end, and we expect that such announcements will be accompanied by lower stock prices. Such events are characterized as 'negative' events.

Events and Data

We restrict our analysis of major events to actual wars, whereas other studies have examined more general military events.¹ Five wars are considered: the Vietnam War (1967-68), the Six Day War (1967), the Yom Kippur War (1973), the Falkland Island War (1982) and the Gulf War (1990-91). Since the Vietnam War was so long, spanning over a decade, we chose to focus only on the two years 1967 and 1968, when that war was at its peak, and announcements therefore less likely to be confounded with other events.

It is clear that some of these events are potentially more important than others in terms of their impact on defense firms' stock prices, since all of the firms included in the sample are American. We would therefore expect a more muted response to those wars (Six Day, Yom Kippur and Falklands Island) that did not directly involve American forces. However, these firms are also likely to be suppliers to non-American combatants, so that we do not expect there to be no response.

Indeed, several of the announcements discussed below are related to US arms shipments to non-American combatants.

For each war except the Viet Nam War, we consider not only the announcement of the outbreak of the conflict, but also a series of prior and/or subsequent announcements that relate to it.

The events were taken from headlines in the *Wall Street Journal Index*. Events were included in the study if the headlines indicated the beginnings of hostilities, an increase in the level of hostilities (such as an increase in troop commitment), the opening of peace talks, or a decrease in hostilities. 'Positive' events are defined as events that increase the probability that war will break out or that the war will escalate. 'Negative' events are defined as events that increase the probability that the war

will cease or that the intensity of fighting will diminish. A summary of the events together with their characterization as 'positive' or 'negative' is found in the Appendix.

The list of events and their categorization is subjective, as is always the case with studies of this kind. Thus, the absence of strong stock market effects in some cases may be due to the fact that the event was simply not very important, and should not have been included. However, some events are clearly more important than others. For example, the formal acceptance by Hanoi of President Johnson's offer of peace talks is quite likely more important an event than was Johnson's earlier pledge in his State of the Union address to seek such talks. Both the subjective nature of the event list, as well as our inability to clearly rank events in terms of importance make the predicted outcomes somewhat uncertain.

The list of defense contractors was obtained from the Department of Defense (1990) list of the largest contractors and each firm on that list was cross-referenced with the CRSP and COMPUSTAT tapes to determine whether financial data was available. Complete data were obtained for between 63 and 69 firms, depending on the event.² The defense portfolio is constructed by taking the average of all the firms' daily returns as reported on the CRSP tapes. The value-weighted index of all the securities included in the CRSP database is used as a proxy for the market portfolio.

Estimation

We measure the response of a portfolio of U. S. defense contractors to war or war-related news by the abnormal returns AR_{it} to the portfolio i at time t , estimated as the prediction error of the market model. Abnormal returns are estimated for each observation within an event window that includes observations corresponding to the days when new information was revealed. The estimated equation for the market model is:

$$R_{it} = \alpha_i + \beta_i R_{Mt} + \sum_{t=t1}^{t2} D_{it} \gamma_{it} + \varepsilon_{it} \quad (1)$$

where R_{it} is the return to portfolio i at time t , β_i is the systematic risk of portfolio i , R_{Mt} is the return to the market portfolio and ε_{it} is the error term. A dummy variable D_{it} is equal to one for the days in the event window $[t_1, t_2]$ and zero otherwise. The interval for t is $[-180, +40]$, that is 180 trading days before the headline date to 40 trading days after (the latter corresponds to approximately 2 calendar months). By using a separate dummy variable for each day in the event window, the estimates of β_i and $\text{var}(\beta_i)$ are identical to those that would be obtained by estimating the market model with pre-event data (Salinger(1992), Karafiath (1988), Eckbo (1990)).

As demonstrated in Karafiath (1988), the estimated coefficient $\hat{\gamma}_{it}$ on the dummy variable represents the abnormal return for portfolio i on day t in the event window. The abnormal returns can be summed over any interval within the event window to form the cumulative abnormal return CAR_{dt} as:

$$CAR_{dt} = \sum_{t=t1}^{t2} \gamma_{it} \quad (2)$$

where dt is the time interval $[t_1, t_2]$. Fama (1998) notes that the usual approach for event studies is to focus on a fairly short window (a few days) around a clearly dated event. Consistent with this, we examine abnormal returns on the announcement day (defined as the date of the publication of the event in the *Wall Street Journal* as well as in various intervals up to 5 trading days (which corresponds to approximately one week of calendar time) before and after the *Wall Street Journal* publication date.

Estimation of (1) by OLS is permitted if the error term has zero mean and constant variance. A variety of tests, including the Engle-ARCH test, the Ljung-Box Q test, and the White

test suggested that such was not typically the case.³ As a consequence all equations are corrected for generalized autoregressive conditional heteroscedasticity (GARCH), using a GARCH(1,1) process (Bollerslev, 1986), given by:

$$\varepsilon_t | \psi_{t-1} \sim N(0, h_t); h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 h_{t-1} \quad (3)$$

where ε_t is a real-valued discrete-time stochastic process, and ψ_t is the information set (σ - field) of all information through time t . The Berndt, Hall, Hall, and Hausman (BHHH) procedure in RATS is used for estimation.⁴

Event Study Results

The event study results are presented in Tables 1-5. For each war and each event, each table summarizes the event and its date, the hypothesized sign of the market response, and a variety of estimated market responses, ranging from the estimated abnormal returns on the announcement date, AR(0), to the cumulative abnormal returns (CAR) over a number of trading days before (-) and after (+) the event.

The results indicate that in the majority of cases the defense portfolio stocks responded to the announcements in the predicted fashion. Announcements that indicated the beginning of a conflict or its likely escalation were accompanied for the most part by increases in the share prices in the period surrounding the event; announcements that indicated the cessation of hostilities or their likely reduction were accompanied for the most part by reductions in share prices.

Very rarely did the market respond in a significant way on precisely the announcement day itself, perhaps suggesting that markets typically either anticipated the event, or responded with a short lag. However, significant abnormal returns were typically observed over the narrow three day window comprising the event day (day 0) and the two trading days (day -1 and day +1) on either side of it. This result is consistent with market efficiency (Fama, 1998), since this three day window

encompasses events that happened on a given calendar day which would be published in the WSJ on the next calendar day (explaining the significance of day -1), as well as events that extend somewhat over one calendar day, beginning on the WSJ pub-

lication date (most of the major war outbreaks including the 100 hour Gulf War extended over one calendar day).⁵

Vietnam War Period Results

The Vietnam War Period comprises 12 events. As shown in Table 1 below, we find some evidence of a statistically significant response in all cases, of which 8 provide evidence that the shares of defence contractors respond to events in the predicted manner. It is not really possible to clearly explain why the portfolio did not respond as expected in some cases. There is the obvious problem of confounding events, for which we can find no particular evidence.

It is possible that we have mis-classified an event, or at least failed to appreciate its full context. Consider, for example the first two events. On 02/07/67 US forces opened a massive assault on Viet Cong headquarters, and this event was greeted negatively by the market, contrary to expectations. However, less than three weeks later (02/24/67) the US launched the biggest offensive of the war to date, and this was accompanied by the hypothesized positive response. The second event was a clear escalation of the war because of the number of troops involved. The first event, however, may have involved far fewer troops and may in fact have been perceived as just another operation. Certainly the market did not respond on the day of the assault on Viet Cong headquarters and the CAR (-1, +1) is also not significant. Thus around the time of this event, no particular response was observed.

The most important of the anomalous results for the Viet Nam War period occurs on

TABLE 1

Abnormal returns for a portfolio of defense contractor stocks on the event date, day 0 (AR(0)) and Cumulative Abnormal Returns (CAR) for intervals surrounding the event date for the Viet Nam War Period.

The event dates (V1,...,V12) are identified as days associated with announcements pertaining to the beginnings of hostilities, an increase in the level of hostilities, the opening of peace talks, or a decrease in hostilities. Abnormal returns are estimated using the market model with a GARCH (1,1) return generating process. The model is estimated for 180 trading days before the event date to 40 days after the event date. The CRSP value weighted index is used as a proxy of the market portfolio.

Event (Day 0) ^a	Expected Sign	AR(0)	CAR(-1, +1)	CAR(-3, +3)	CAR (-5, +5)
V1 (67/02/07)	+	-.002	-.010	-.026**	-.038**
V2 (67/02/24)	+	-.001	.006**	.028**	.018**
V3 (67/03/02)	+	-.005	-.001	.016**	.023**
V4 (67/04/25)	+	.006*	.009**	.014**	.010**
V5 (67/07/14)	+	.002	-.006**	-.014**	-.021**
V6 (67/08/04)	+	-.006**	-.004**	-.003	-.018**
V7 (67/12/22)	-	-.005	-.011**	-.007**	-.052**
V8 (68/01/08)	-	-.012	-.030**	-.048**	-.080**
V9 (68/01/18)	-	-.007**	-.012**	-.020**	-.030**
V10(68/02/14)	+	.013**	.013**	.023**	.036**
V11(68/04/02)	+	.005	.016**	.008**	.024**
V12(68/04/09)	-	.011**	.010**	.010**	.022**

Notes to Table 1: ** Significant at 5%; * Significant at 10%; ^a The headlines for the event dates V1,...,V12 are shown in Appendix A.

04/07/68, when WSJ reported that Hanoi had officially accepted President Johnson's bid for talks on Vietnam. The predicted sign for an event which promises the reduction of hostilities is negative (for defense stocks), yet we observe large, significant and positive abnormal returns on the day of the announcement, and for the days surrounding it. There are a number of possible explanations.

First, it is possible that news perceived as significantly good by the market as a whole spills over to the defense portfolio. We say significant good news, because it is to be noted that there are other occasions when the possibility of conflict-reducing actions produced the hypothesized negative market response. For example, the announcement on 12/22/67 that Presidents Johnson and Thieu had agreed on terms for peace talks was

greeted by a negative response. This agreement may have been perceived as less likely to end the war by the market as a whole, thus reducing any potential spill-over effect.

Second, events must be considered in their contexts. The acceptance of peace talks by Hanoi came soon after the Tet Offensive of February 1968. In our data set, the effects of the Tet Offensive are recorded by the granting of General Westmoreland's request for more troops (02/14/68), a request made in response to the Tet Offensive, and the first recognition we could find in the WJS of the severity of that event. This event was accompanied by the largest positive set of abnormal returns in our Vietnam sample. Clearly defense shares responded positively to this escalation of the war, as was hypothesized, but it is also

true that the Tet Offensive signalled a new phase in the war, and called into question whether the war would ever end and indeed if the US would prevail (Herring, 1986). Thus, the acceptance of peace talks by Hanoi may have been greeted positively even for defense shares because it represented an alternative to losing the war.

Six Day War Period Results

The Six Day War period comprises four events, three prior to the outbreak of war on June 5, 1967. As shown in Table 2, three of the four events produce results consistent with our hypothesis.

On January 16, 1967 U. N. Secretary General U Thant warned of a possible war in the region. There was no market response on the day of the warning, but for periods surround the warning there were negative and significant abnormal returns, contrary to what we would expect.

However, when Israel and Syria agreed to refrain from hostile acts on January 25, there was a significant negative response for the three days before and after the event, although no response was observed on the announcement date. We take this as being consistent with the hypothesis.

In May of 1967, Egypt began to mobilize its forces and the threat of war escalated. Again, there was no response on the day of the announcement, but significant positive effects were observed for a variety of periods surrounding the event date.

When war broke out on June 5, 1967 (reported on June 6 in WSJ), the response was immediate, positive and large. On the event day (-1), a 1.5% abnormal return was observed (not reported), and very large and significant positive abnormal returns were observed for all periods surrounding the event.

These results suggest that more important information, such as the actual outbreak of war is accompanied by larger responses.

Yom Kippur War Period Results

There are five announcements considered for the Yom Kippur War. As shown in Table 3 only two of these announcements yield abnormal return estimates that are consistent with the advanced hypothesis, while one produces mixed results.

On October 10, 1973, WJS reported that tanks clashed in the Sinai, and that Israel bombed inside Syria and Egypt. There was no response on the announcement day, but a significant positive response for the three days surrounding the event, the result that we would expect. However, as a longer event window is considered, the market response is in fact negative, for which we have no explanation.

On October 15, 1973 Egypt attacked along the Suez Canal, and Saudi Arabia sent troops to the Syrian front, prompting the U. S. to send jets to Israel, while the USSR was doing the same for Arab countries. The response to these events was primarily negative, contrary to expectations.

When a truce was declared at the Suez Canal on October 23, 1973 the market response was negative, as expected. However, when Egypt and Israel agreed to a preliminary peace plan in November of 1973, the market response was in fact positive, a result similar to that encountered when peace talks were agreed to in the Vietnam War.

When the U. S. House of Representative moved, on December 5, 1973, to provide Israel with \$2.2 billion worth of military aid, the market response was swift and large. In this case, the abnormal return on the event day was positive and significant, as was the three day CAR. Thus a direct announcement of military assistance was greeted with the expected response.

Falklands War Period Results

Argentina invaded the Falklands Islands on April 2, 1982. We restrict our analysis to the

TABLE 2

Abnormal returns for a portfolio of defense contractor stocks on the event date, day 0 (AR(0)) and Cumulative Abnormal Returns (CAR) for intervals surrounding the event date (day 0) for the Six Day War Period.

The event dates (S1,...,S4) are identified as days associated with announcements pertaining to the beginnings of hostilities, an increase in the level of hostilities, the opening of peace talks, or a decrease in hostilities. Abnormal returns are estimated using the market model with a GARCH (1,1) return generating process. The model is estimated for 180 trading days before the event date to 40 days after the event date. The CRSP value weighted index is used as a proxy of the market portfolio.

Event (Day 0) ^a	Expected Sign	AR (0)	CAR(-1, +1)	CAR(-3, +3)	CAR(-5, +5)
S1 (67/01/16)	+	-.006	-.004**	-.016**	-.036**
S2 (67/01/26)	-	.001	-.003	-.015**	-.027**
S3 (67/05/22)	+	.006	.012**	.012**	.007**
S4 (67/06/06)	+	-.003	.014**	.023**	.030**

Notes to Table 2: ** Significant at 5%; * Significant at 10%; ^a The headlines for S1,...,S4 are shown in Appendix A

TABLE 3

Abnormal returns for a portfolio of defense contractor stocks on the event date, day 0 (AR(0)) and Cumulative Abnormal Returns (CAR) for intervals surrounding the event date (day 0) for the Yom Kippur War Period.

The event dates (Y1,...,Y5) are identified as days associated with announcements pertaining to the beginnings of hostilities, an increase in the level of hostilities, the opening of peace talks, or a decrease in hostilities. Abnormal returns are estimated using the market model with a GARCH (1,1) return generating process. The model is estimated for 180 trading days before the event date to 40 days after the event date. The CRSP value weighted index is used as a proxy of the market portfolio.

Event (Day 0) ^a	Expected Sign	AR (0)	CAR (-1, +1)	CAR (3, +3)	CAR (-5, +5)
Y1 (73/10/10)	+	-.005*	.002**	-.001	-.009**
Y2 (73/10/15)	+	-.007	-.004**	-.005**	-.023**
Y3 (73/10/23)	-	.002	-.005**	-.013**	-.019**
Y4 (73/11/09)	-	-.003	.015**	.025**	.031**
Y5 (73/12/05)	+	.019**	.015**	-.000	.003

Notes to Table 3: ** Significant at 5%; * Significant at 10%; ^a The headlines for Y1,...,Y5 are shown in Appendix A.

period of direct British involvement in that conflict. As shown in Table 4 below, there are five announcements analyzed, of which three exhibit the expected response. However, all announcements studied brought relatively small responses, particularly those that displayed signs contrary to expectations.

The first indication of such involvement came on April 5, 1982 when the WSJ reported that Britain and Argentina were near armed confrontation over the invasion which occurred on April 2. April 5 was the first trading day after that event, so that the AR on day -1 represents the event day and it is positive and significant. The CARs for this period are all positive and statistically significant, as is expected.

On April 22, Francis Pym the British Foreign Secretary announced that the British navy would go into action even while peace talks were continuing. This announcement was greeted in a somewhat mixed manner. On the announcement day, the AR was negative and significant, but on the previous day (not shown) a significant and positive AR was observed (as expected). Thus the three day CAR (-1, +1) is not significant. However, subsequent days saw positive AR's and so the longer term CARs show positive and significant signs.

On May 19, Prime Minister Thatcher issued a final ultimatum to Argentina, and two days later Britain did indeed invade. On the announcement date, the AR was negative, not the sign predicted, although it was positive and significant on the previous day. No significant AR was observed on the invasion day. Again, the consequence is that the shorter term CARs are not significant. The longer term CARs are statistically significant and of the wrong sign, but are quite small.

On May 28, the U. S. began to ship Britain a variety of weapons and military gear, in part as a response to major Argentinean air attacks that sunk a number of British ships. Although the AR on day 0 was negative, contrary to expectations, it was positive and statistically significant on the pre-

vious day. Once again, the result is that the CAR (-1, +1) is not statistically significant.

The headline for June 11 is somewhat misleading. Although it pertains to statements made by US officials, the date in fact coincided with further Argentinean attacks that resulted in the largest British setback of the war, as well as the largest number of casualties. In response to this escalation, there were positive and significant responses on the announcement date and for the days surrounding the event, as expected.

Gulf War Period Results

There are three announcements in the Gulf War period, and in each case, shown in Table 5 below, the portfolio responded in the expected way in the period surrounding the announcement.

On August 2, 1990 Iraq invaded Kuwait, and this was reported in WSJ on the following day with a headline indicating that the invasion could help President Bush stave off reductions in defense expenditures. Although there was no significant AR on the announcement day, or the previous day, the three-day CAR (-1, +1) is positive and significant as expected. However, over the longer window (-5, +5), the event is not significant, indicating that the market responds rapidly and in a focused way to the information.

On January 16, 1991 the bombing of Iraq by U. S. and other forces began, and it was reported on that date. Again, there is no evidence of abnormal returns on any particular day, but the CARs are positive, significant and quite high for the week surrounding the event.

On February 13, 1991 Iraq indicated for the first time that it was prepared to accept a diplomatic solution to the crisis. While no single day abnormal returns are observed, all of the CARs are consistently negative and significant, as expected.

Summary of Event Study Analysis

We have examined 29 announcements

TABLE 4

Abnormal returns for a portfolio of defense contractor stocks on the event date, day 0 (AR(0)) and Cumulative Abnormal Returns (CAR) for intervals surrounding the event date (day 0) for the Falkand Island War Period.

The event dates (F1,...,F5) are identified as days associated with announcements pertaining to the beginnings of hostilities, an increase in the level of hostilities, the opening of peace talks, or a decrease in hostilities. Abnormal returns are estimated using the market model with a GARCH (1,1) return generating process. The model is estimated for 180 trading days before the event date to 40 days after the event date. The CRSP value weighted index is used as a proxy of the market portfolio.

Event (Day 0) ^a	Expected Sign	CAR -1, +1	CAR -3, +3	CAR -5, +5
F1 (82/04/05)	+	.007**	.006*	.013**
F2 (82/04/22)	+	-.001	.003**	-.001
F3 (82/05/19)	+	-.000	.001	-.009**
F4 (82/05/28)	+	-.000	-.004**	-.001
F5 (82/06/11)	+	.004**	.004**	.007**

Notes to Table 4: ** Significant at 5%; * Significant at 10%; ^a The headlines for F1,...,F5 are shown in Appendix A.

TABLE 5

Abnormal returns for a portfolio of defense contractor stocks on the event date, day 0 (AR(0)) and Cumulative Abnormal Returns (CAR) for intervals surrounding the event date (day 0) for the Gulf War Period.

The event dates (G1,G2,G3) are identified as days associated with announcements pertaining to the beginnings of hostilities, an increase in the level of hostilities, the opening of peace talks, or a decrease in hostilities. Abnormal returns are estimated using the market model with a GARCH (1,1) return generating process. The model is estimated for 180 trading days before the event date to 40 days after the event date. The CRSP value weighted index is used as a proxy of the market portfolio.

Event (Day 0) ^s	Expected Sign	AR(0)	CAR (-1, +1)	CAR (-3, +3)	CAR(-5, +5)
G1 (90/08/03)	+	.008	.008**	.001	-.001
G2 (91/01/16)	+	.005	.032**	.065**	.060**
G3 (91/02/13)	-	.003	-.011**	-.006**	-.017**

Notes to Table 5: ** Significant at 5%; * Significant at 10%; ^a The headlines associated with G1, G2, and G3 are shown in Appendix A.

spread over 5 different conflicts. 21 of these indicated the outbreak of war, or an increase in the probability that a war would occur or would escalate. 8 indicated the cessation of hostilities, or an increase in the probability that hostilities would cease. We suggested that the former announcements would be accompanied by abnormal positive returns to a defense portfolio, and we found confirming evidence in 13 cases.⁶ We also suggested that the latter type of announcements would be accompanied by abnormal negative returns, and we found confirming evidence in 6 cases. Thus on balance, we confirm the findings of previous studies that war-related events positively effect defense shares, and we extend these results to suggest that peace-related announcements have the opposite effect.

Firm-Specific Effects

We have provided evidence that a portfolio consisting of defense contractors responds positively to war-related news and negatively to peace-related news. We now extend the analysis by asking whether certain stocks in the portfolio are more responsive to announcements than others. Specifically, we attempt to explain variations in a cross-section of firm-level CARs, using firm- and industry-specific characteristics as explanatory variables.

We use the Gulf War period for this analysis because complete firm-level data were most readily available. We estimate the following equation:

$$CAR(-1,+1)_i = \alpha + \beta_1 RD_i + \beta_2 CE_i + \beta_3 CR_4i + \varepsilon_i \quad (4)$$

where $CAR(-1,+1)_i$ is the CAR for the three days centered on the announcement day for each firm i ; RD is the ratio of research and development expenditures to sales for each firm i ; CE is the ratio of capital expenditures to sales for each firm i ; CR is the four-firm concentration ratio for the four digit industry to which firm i is assigned.⁷

The ratio of research and development

expenditures to sales is chosen as a proxy for the relative technical sophistication of the company, and its ability to produce technologically superior goods. These are of course critical factors in the defense industry and we therefore expect that companies with higher levels of RD should have higher CARs, other things equal. Thus, β_1 is hypothesized to be positive.⁸

Many of the assets required to produce weapons systems are specific to the defense industry. Williamson (1979) has argued that asset-specificity can result in high transaction costs, and Rogerson (1994) suggests that such costs are particularly high in the case of defense contractors. Thus, firms that commit themselves to high levels of capital spending may expose themselves to possible hold-up problems by the government. If this is the case, the market would consider firms with above average levels of capital spending to be at a bargaining disadvantage, with the result that abnormal returns would be lower, other thing equal. We therefore hypothesize that β_2 will be negative.

The four-firm concentration ratio measures the degree of market power held by firms in that industry. In markets with fewer firms, or where a small number of firms have large market shares, sellers have a relative bargaining advantage because of the absence of substitute products. Investors may therefore prefer firms in more concentrated industries, leading to the hypothesis that β_3 is positive.

Equation (4) is estimated by OLS.⁹ The

CARs are for the three days surrounding the Allied bombing of Iraq on January 16, 1991. Data for R&D and capital expenditures are taken from *COMPUSTAT*. The same source was used to identify the four-digit industry in which the firm operated, and the concentration ratios were then taken from the *U.S. Census of Manufactures*. The sample comprises 47 firms for which data could be obtained and are available from the authors on re-

quest.

The results are reported in Table 6, and indicate that the valuation effects of the Allied air attack on Iraq did in fact differ across firms, and in a manner consistent with our hypotheses. Thus, we find that markets responded more favourably to firms with above average levels of R&D expenditures and firms in industries that were more concentrated; markets responded less favourably to firms with above-average levels of capital expenditures. The RD and CR coefficients are statistically significant at 5% levels, while the CE coefficient is statistically significant at the 10% level.

Summary and Conclusions

We have examined the response of portfolios of defense shares to war- and peace-related

news. In accordance with expectations, and consistent with other studies, the majority of the evidence confirms that the outbreak of war, or announcements that increase the probability of a war commencing or escalating, are accompanied by positive abnormal returns. Similarly, extending previous studies to include peace-related news, we confirm that such news is for the most part associated with negative abnormal returns.

On balance, our results support the view that markets, when defined in the appropriate way, do respond to relevant announcements. However, our results are not unanimous in finding responses of the hypothesized sign, and in this sense are not as strong as results provided by other studies. There are a number of possible reasons to explain the anomalous results.

First, the number of firms included in

TABLE 6

Cross-sectional tests of firm and industry specific variables affecting abnormal return performance for defense contractor firms during the Gulf War

The equation estimated is:

$$CAR(-1,+1)_i = \alpha + \beta_1 RD_i + \beta_2 CE_i + \beta_3 CR_i + \varepsilon_i \quad (4)$$

The dependent variable $CAR(-1,+1)_i$ is the cumulative average residual for firm i during the three day period surrounding the Allied bombing of Iraq on January 16, 1991. The CAR is estimated using a GARCH (1,1) process for stock returns; the estimation interval is over the period 180 trading days before to 40 days after January 16, 1991. The independent variables are: RD_i = the ratio of research and development expenditures to sales for firm i ; CE_i = the ratio of capital expenditures to sales for firm i ; CR_i = the four-firm concentration ratio for the four digit industry to which firm i is assigned. Equation (4) is estimated for 47 defense contractors for which complete data are available.

Dependent Variable	Independent Variables			
	Constant	RD	CE	CR
CAR (-1, +1)	-0.0205 (-.8434)	0.6096** (2.0833)	-0.4153* (-1.9015)	0.0894** (2.3473)

Notes to Table 6: $R^2 = 0.33$; $F = 3.578^{**}$; ** Significant at 5% level; * Significant at 10% level t-statistics in parentheses.

our defense portfolio is somewhat larger than has been previously employed. It is possible that the larger number of firms includes a different mix of firms, for example either smaller firms or firms that are not exclusively defense contractors. In both cases one might expect that abnormal returns to be lower, and in the case of firms which rely heavily on non-defence production, the returns may move in the opposite direction.¹⁰ In addition, our results suggest that abnormal returns differ according to firm-specific characteristics and the expanded sample may include firms with different characteristics.

Secondly, we have obtained our estimates of abnormal returns using the GARCH specification. This procedure accounts for the observed time-varying volatility and volatility clustering of stock returns. As shown by Connolly (1991), the single factor market model approach may be biased as a result of specification errors, in the presence of GARCH effects. However, we also estimated all equations by ordinary least squares, and while these estimates were sometimes slightly different in magnitude, we could detect no systematic differences in the signs or significance.

Finally, we did not restrict our events/announcements to the beginning of a major conflict. Rather, we included announcements both prior to and subsequent to the outbreak of the conflict. These announcements cannot be interpreted as unambiguously, mainly because it is difficult to determine whether the event itself was really important and the context in which it took place. Announcements drawn from newspaper headlines may not reveal the anticipations leading up to the event, or subsequent to it. For example, a successful offensive by the U. S. during the Vietnam War, interpreted by us as signalling an escalation of the War, may in fact lead to the anticipation that the war will end. Thus, we would have predicted a positive response, but will have observed a negative response. We have found that unambiguous announcements of war, such as the Six-Day or Gulf Wars, have been associated with larger abnormal returns.

Given the potential for ambiguity, our results do on balance suggest that a portfolio of defense stocks will generate abnormal returns when reacting to announcements of war and peace. Investors seeking to diversify their holdings can do so. Our results indicate that in building a defense portfolio, investors should focus on firms with high levels of R&D operating in highly concentrated industries, and should avoid firms with excessive capital expenditures.

Directions for Future Research

Our sample has been restricted to US firms, and future research should focus on defense contractors from other countries. Our results do suggest that in the war where U. S. involvement was minimal (Falklands), the observed abnormal returns to U. S. contractors were very small. The response of British and European defense contractors may well have been larger.

A few anomalous results remain and call for further investigation, perhaps by undertaking a more careful historical evaluation of the events. In addition, a larger sample of wars could be analyzed and the analysis of inter-firm differences in abnormal returns could be expanded. □

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APPENDIX A

List of events from the Wall Street Journal. The first column contains the headline date, the second contains the headline and the third contains the expected sign of the abnormal return; **P** for positive and **N** for negative.

Headline Dates	Headlines in the Wall Street Journal	ES
	VIETNAM	
02/07/67	U.S. forces opened massive assault on Vietcong's national headquarters.	P
02/24/67	Biggest offensive of Vietnam's war launched by 45,000 U.S. troops.	P
03/02/67	Senate pledged full support of American fighting forces in South Vietnam.	P
04/25/67	Step-Up in Vietnam: Strikes in MIG bases seen as signalling big expansion of war; new bombing targets likely; U.S. troop-strength goal may be increased by 50,000.	P
07/14/67	President Johnson, Gen. Westmoreland agreed on need for more troops in Vietnam.	P
08/04/67	U.S. troop commitments in Vietnam to be increased by 45,000 by July 1968.	P
12/13/67	About 10,000 troops flying in South Vietnam from U.S. in massive airlift.	P
12/22/67	President Johnson and President Thieu agreed on conditions for Saigon- Vietcong peace talks.	N
01/08/68	Vietnam war's end is beginning 'to come into view' Gen. Westmoreland said.	N
01/18/68	President Johnson, in State of the Union Message, pledged to seek 'complete cessation' of Vietnam hostilities.	N
02/14/68	Vietnam to get 10,500 more U.S. troops in response to Gen. Westmoreland's request.	P
04/02/68	U.S. to activate 60,000 reservists soon; a third of them to be slated for Vietnam.	P
04/09/68	Hanoi formally accepted President Johnson's bid for talks on Vietnam.	N
	6 Day War	
01/16/67	Israeli-Syrian buildup of troops threatens major clash soon, U Thant warned.	P
01/26/67	Israel, Syria agreed to refrain from hostile acts that could spark border war.	N
05/22/67	Cairo ordered total mobilization of reserves in confrontation with Israel.	P
06/06/67	War broke out in the Middle East: Israel said it pushed into the Sinai Peninsula.	P
	YOM KIPPUR	
10/10/73	Israel bombed inside Syria and Egypt; tanks battled in the Sinai desert.	P
10/15/73	U.S. will send jets to Israel to help counter supplies Soviets are airlifting to Arabs.	P
10/23/73	A Mideast truce took effect at the Suez; Iraq, Lybia rejected it; Syria held out.	N
11/09/73	Israel and Egypt agreed to a preliminary peace plan, U.S. officials said.	N
12/05/73	House moved toward providing Israel with \$2.2 billion to replace arms used up or destroyed in the recent Middle East war.	P

	FALKLANDS	
04/05/82	Britain, Argentina near confrontation over Argentine invasion of Falklands.	P
04/22/82	British foreign Secretary Francis Pym indicates that Britain's navy could go into action even while Falkland Islands peace talks continue.	P
05/19/82	Prime Minister Margaret Thatcher issued ultimatum to Argentina, warning that if UN talks fail to solve the Falkland Islands conflict in a day or so Britain will be forced to recover the islands militarily.	P
05/28/82	U.S. has begun to ship Britain a large variety of weapons and military gear to bolster its Falklands war effort.	P
06/11/82	Peru and Venezuela are helping Argentina replace some of the warplanes it has lost fighting with Britain over the Falkland Islands, U.S. officials contend.	P
	GULF WAR	
08/03/90	The Iraqi invasion of Kuwait is bound to help President Bush's efforts to stave off some defence reductions. Big cuts are still likely, but the crisis changes the mood.	P
01/16/91	The US-led air attack on Iraq opened with nearly flawless bombing raids on Jan. 16, 1991, achieving a strong measure of surprise, suppressing Iraqi defences and seizing the skies over Iraq and Kuwait;	P
02/13/91	Iraq said that it is ready to work with the USSR to end the Persian Gulf War, the first time since the war started that Iraq has indicated it may want a diplomatic way out of the crisis.	N

Endnotes

1. For example, McDonald and Kendall (1994) include events such as the U.S. rescue attempt in Iran.
2. The list of firms is available from the authors on request.
3. The test results are available on request.
4. We also estimated the market model with corrections for non-synchronous trading and beta shifts at the event date. These results were not different from those of the market model estimated by OLS. In addition, the Chow-test suggested that beta shifts did not occur. Details are available from the authors.
5. We estimated CARs for a number of extended event windows. These results are not presented since they did not change our conclusions in any way.
6. The remaining 8 cases did not all directly refute the hypothesis. In 3 cases, the evidence was ambiguous in the sense that both positive and negative abnormal returns were observed.
7. An average concentration ratio is used for firms operating in more than one sector of the defense industry.
8. R&D expenditures might also be seen as a useful forecasting measure of the profitability of the firm, although Hall (1993) suggests that the stock market's valuation of the intangible capital created by investment in R&D in the U.S. has fallen in the latter part of the 1980's compared with earlier decades. More recently, Sundaram, John, and John (1996) demonstrate that the stock market's response to R&D announcements is linked to the nature of

competition in the industry. In particular, they show that the announcement effect to R&D spending increases is positive (negative) for firms that compete in strategic substitutes (complements) where competitors passively (aggressively) accommodate (match) the firms' spending. Chan, Martin, and Kensinger (1991) show that the stock market's response to a company's R&D spending is positive and significant for high-tech firms that are more R&D intensive - factors that characterize the firms in our sample.

9. Goldfeld-Quant and White tests did not reveal any heteroscedasticity at the 10% level.
10. We note that Pepall and Shapiro (1991) find that the proportion of output devoted to military contracts is not a significant determinant of profitability in Canada.

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