Invited Editorial

Trading in option contracts before large price changes: A comparative study of US and UK markets

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ABSTRACT **Previous studies indicate that traders in possession of important information are more likely to transact in option contracts rather than the underlying asset. This article examines stock option trading volume before significant price changes in the underlying stock for all S&P100 and FTSE 100 constituent stocks. Our findings indicate irregular option trading volume before a significant amount of large price changes. This effect is less pronounced in the UK market.**

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Keywords: price shocks; informed trading; option markets; trading volume

INTRODUCTION

Previous studies indicate that traders in possession of important information are more likely to transact in option contracts rather than the underlying asset because of lower transactions costs, higher leverage and downside protection (Black, 1975; Lee and Cheong, 2001; Chakravarty *et al*, 2004, among others). Irrespective of the exact option strategy, the increased trading will result to increased call and put trading volume before the information is released (Jayaraman *et al,* 2001; Cao *et al*, 2005; Arnold *et al*, 2006).

This article examines, for the first time, trading volume in individual stock option contracts *before* large stock price changes in the underlying stock and offers original comparative evidence for the US and UK markets. Owing to differences in regulation between the two markets, we may expect a different pattern with regard to trading by informed investors (Fidrmuc *et al*, 2006). Kyriacou *et al* (2008), for example, argue that there is a disparity in informed trading between US and UK executives' option trades because of the number of differences between the two markets. These differences may stem from the proportion of executive remuneration linked to options, option market regulation, taxation differences on the profits from option trading or from differences in shareholder practices between the two markets (for more details, see Franks *et al*, 2001; Faccio and Lasfer, 2002, among others).

Large stock price changes imply that significant unanticipated related information has arrived in the market and investors react to this information. Previous studies on price shocks concentrate on investor behaviour *after* the event, with the results suggesting that stock market participants tend to overreact to significant negative price changes and not react (or react mildly) to large positive price changes (Brown *et al*, 1988; Atkins and Dyl, 1990; Bremer and Sweeney, 1991; Chan, 2003, among others). Spyrou (2011) discusses this gap in the literature and reports abnormal trading volume in index option contracts before days of abnormally high or low index returns. To anticipate the results, for a large number of significant (positive and negative) price changes in the underlying stock we find abnormal (call and put) option trading volume *before* the event; the effect is less pronounced for the United Kingdom.

DATA AND TESTING METHODOLOGY

The sample for the empirical analysis consists of all the S&P100 index and FTSE100 constituent stocks for the period between May 2008 and March 2011.[1] Returns are defined as the first difference of the logarithmic price level and all price data and daily option trading volume data are collected from DataStream. Daily option trading volume is defined as the number of option contracts traded on each day (total cumulative volume for all individual option series).

Previous studies use various definitions for extreme events, such as a price drop of 10 per cent, a weekly price change of more than 50 per cent, the largest stock price change in a 300-day window and so on (see, among others, Atkins and Dyl, 1990; Bremer and Sweeney, 1991; Dennis and Strickland, 2002). We use the following definition: a price shock for a given stock occurs on a day where the stock return is above (positive shock) or below (negative shock) three standard deviations the average daily stock return computed over the (−60 to −11) days

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before the given day. The window ends 10 trading days before the event day in order to avoid possible price lead-up preceding the shocks. The standard deviation for day t is also computed from the observations between day t-60 and day t-11. This definition accounts for the varying volatility between assets (for a similar definition see also Lasfer *et al*, 2003; Spyrou, 2011).

If price shocks are anticipated by traders we should observe abnormal option trading volume for the period preceding price shocks. To test this hypothesis we use a comparison period approach, that is, the pre-event option trading volume is compared with the trading volume of a benchmark period (see Amin and Lee, 1997; Jayaraman *et al*, 2001; Cao *et al*, 2005, among others). Option trading volume is logarithmically transformed (Sanders and Zdanowicz, 1992) to account for the variation in the number of option contracts traded daily:

$$V_{i,t} = \ln(1 + \text{Number of call (put) contracts on stock } i \text{ traded on day } t) \quad (1)$$

The benchmark period trading volume is defined as the average trading volume for a 100-day period preceding the event and ending 41 days before the event (−141 to −41):

$$\overline{V}_{b,i} = \frac{1}{100} \sum_{t=-140}^{-41} V_{it} \quad (2)$$

The pre-event option trading volume, or testing period volume, is defined as the average trading volume of the two trading weeks (10 trading days) immediately preceding the day of the large price change:

$$\overline{V}_{p,i} = \frac{1}{10} \sum_{t=-10}^{0} V_{it} \quad (3)$$

The null hypothesis is Hypothesis 0: $V_{p,i} = V_{b,i}$, that is, the pre-event volume is equal to the benchmark volume and the alternative hypothesis is Hypothesis 1: $V_{p,i} \neq V_{b,i}$, that is, the pre-event volume is different to the benchmark volume. Rejection of the null implies abnormal trading volume before the price shock. Standard t-tests are used to evaluate the significance of difference in volume between benchmark and pre-event periods.

In order to test the robustness of the results and whether investment style plays a role, we split the sample stocks to High Book/Market (B/M) and Low B/M sorts ('value' and 'growth' stocks) and Large Capitalisation and Smaller Capitalisation sorts ('big' and 'smaller' stocks). Moreover, we use two additional 'pre-event' periods (−20 and −30 days relative to the event) and two additional benchmark periods (−161 to −41) and (−181 to −41). As a result, we obtain nine different combinations of pre-event and benchmark periods, for each type of shock (positive and negative), for each type of option (call and put) and for all style portfolios.

RESULTS

Tables 1 and 2 present the results for the US full sample and the UK full sample for positive and negative price shocks and for call and put contracts. In Table 1, Panel A presents results for the case where a benchmark period of (−141 to −40) days is used and Panel B for the case where a benchmark period of (−161 to −40) days is used. The results for the (−181 to −40) benchmark period are qualitatively the same and are not reported in the article (available upon request). Panel A1 (B1) presents results for a pre-event period of 10 days, Panel A2 (B2)

Table 1: Abnormal option trading volume before price shocks: US stocks (full sample)

Panel A: Benchmark period: 141–41 days	*Positive shocks*		*Negative shocks*		*Panel B: Benchmark period: 161–41 days*	*Positive shocks*		*Negative shocks*	
	Call	*Put*	*Call*	*Put*		*Call*	*Put*	*Call*	*Put*
Panel A1: Pre-event period 10 days					*Panel B1: Pre-event period 10 days*				
Percentage of: $V_p > V_b$	69.78	64.01	65.90	63.39	Percentage of: $V_p > V_b$	72.14	66.30	66.54	64.41
Reject Hypothesis 0 at 5 per cent	35.16	31.87	35.84	34.30	Reject Hypothesis 0 at 5 per cent	38.72	34.26	37.52	35.01
Mean V_b	7.23	6.75	7.35	6.85	Mean V_b	7.22	6.73	7.34	6.83
Mean V_p	7.54	6.95	7.63	7.08	Mean V_p	7.56	6.98	7.63	7.08
Mean abs *t* stat	1.87	1.69	1.81	1.74	Mean abs *t* stat	1.95	1.78	1.83	1.78
Panel A2: Pre-event period 20 days					*Panel B2: Pre-event period 20 days*				
Percentage of: $V_p > V_b$	66.21	58.24	62.81	54.91	Percentage of: $V_p > V_b$	68.80	62.12	64.02	56.48
Reject Hypothesis 0 at 5 per cent	40.38	36.81	36.8	38.54	Reject Hypothesis 0 at 5 per cent	43.73	40.67	38.68	40.43
Mean V_b	7.23	6.75	7.35	6.85	Mean V_b	7.22	6.73	7.34	6.83
Mean V_p	7.45	6.85	7.53	6.95	Mean V_p	7.48	6.88	7.54	6.95
Mean abs *t* stat	2.14	1.88	1.91	1.91	Mean abs *t* stat	2.25	2.02	1.99	1.98
Panel A3: Pre-event period 30 days					*Panel B3: Pre-event period 30 days*				
Percentage of: $V_p > V_b$	60.99	52.75	58.77	50.10	Percentage of: $V_p > V_b$	64.62	55.99	60.35	51.84
Reject Hypothesis 0 at 5 per cent	46.15	41.21	39.69	40.27	Reject Hypothesis 0 at 5 per cent	48.75	45.96	40.43	42.75
Mean V_b	7.23	6.75	7.35	6.85	Mean V_b	7.22	6.73	7.34	6.83
Mean V_p	7.39	6.79	7.47	6.88	Mean V_p	7.42	6.82	7.48	6.88
Mean abs *t* stat	2.37	2.16	2.00	2.04	Mean abs *t* stat	2.50	2.29	2.10	2.12

Notes: The null hypothesis (Hypothesis 0) is that: $[V_b = V_p]$, that is, the pre-event option volume is equal to the benchmark period volume. The percentage in the line denoted as 'Reject Hypothesis 0 at 5 per cent' is the percentage of events for which the null is rejected at the 5 per cent of significance. There are 364 (519) positive (negative) shocks in the sample. Mean volume (V) is defined as ln(1+number of call (put) contracts of index i traded on day t). 'Mean V_b' is the mean volume for the benchmark period across all events. 'Mean V_p' is the mean volume for pre-event period across all events. 'Mean abs *t* stat ' is the absolute mean *t*-statistics for the (Hypothesis 0).

Table 2: Abnormal option trading volume before price shocks: UK stocks (full sample)

Panel A: Benchmark period: 14–41 days					*Panel B: Benchmark period: 161–41 days*				
	Positive shocks		*Negative shocks*			*Positive shocks*		*Negative shocks*	
	Call	*Put*	*Call*	*Put*		*Call*	*Put*	*Call*	*Put*
Panel A1: Pre-event period 10 days					*Panel B1: Pre-event period 10 days*				
Percentage of: $V_p > V_b$	51.02	53.41	53.05	53.86	Percentage of: $V_p > V_b$	51.33	53.62	52.17	54.53
Reject Hypothesis 0 at 5 per cent	19.28	23.23	25.51	18.89	Reject Hypothesis 0 at 5 per cent	19.44	24.52	26.09	18.26
Mean V_b	4.35	4.21	8.56	4.39	Mean V_b	4.35	4.21	8.56	4.39
Mean V_p	4.40	4.3	8.71	4.45	Mean V_p	4.41	4.31	8.72	4.45
Mean abs *t* stat	1.24	1.32	1.4	1.25	Mean abs *t* stat	1.25	1.33	1.41	1.26
Panel A2: Pre-event period 20 days					*Panel B2: Pre-event period 20 days*				
Percentage of: $V_p > V_b$	52.57	54.49	53.41	52.19	Percentage of: $V_p > V_b$	51.81	55.07	52.29	51.55
Reject Hypothesis 0 at 5 per cent	25.15	24.79	29.46	21.59	Reject Hypothesis 0 at 5 per cent	26.57	25.97	30.19	21.76
Mean V_b	4.35	4.21	8.56	4.39	Mean V_b	4.35	4.21	8.56	4.39
Mean V_p	4.39	4.29	8.68	4.41	Mean V_p	4.39	4.29	8.69	4.42
Mean abs *t* stat	1.37	1.44	1.54	1.34	Mean abs *t* stat	1.39	1.46	1.55	1.36
Panel A3: Pre-event period 30 days					*Panel B3: Pre-event period 30 days*				
Percentage of: $V_p > V_b$	50.06	54.13	52.93	51.03	Percentage of: $V_p > V_b$	50.72	55.31	52.78	50.52
Reject Hypothesis 0 at 5 per cent	25.03	26.47	28.50	23.39	Reject Hypothesis 0 at 5 per cent	26.09	27.66	30.68	25.39
Mean V_b	4.35	4.21	8.56	4.39	Mean V_b	4.35	4.21	8.56	4.39
Mean V_p	4.37	4.26	8.63	4.39	Mean V_p	4.38	4.27	8.64	4.40
Mean abs *t* stat	1.4	1.43	1.54	1.38	Mean abs *t* stat	1.44	1.47	1.57	1.41

Notes: The null hypothesis (Hypothesis 0) is that: $[V_b = V_p]$, that is, the pre-event option volume is equal to the benchmark period volume. The percentage in the line denoted as 'Reject Hypothesis 0 at 5 per cent' is the percentage of events for which the null is rejected at the 5 per cent of significance. There are 835 (778) positive (negative) shocks in the sample. This is higher to the US full sample because of the longer sample period for the UK full sample. Mean volume (V) is defined as ln(1+number of call (put) contracts of index i traded on day t). 'Mean V_b' is the mean volume for the benchmark period across all events. 'Mean V_p' is the mean volume for pre-event period across all events. 'Mean abs *t* stat ' is the absolute mean *t*-statistics for the (Hypothesis 0).

presents results for a pre-event period of 20 days, and Panel A3 (B3) presents results for a pre-event period of 30 days. Within each sub-panel the first line presents the percentage of shocks for which the pre-event option trading volume is higher than the benchmark option trading volume ($V_{p,i} > V_{b,i}$), the second line presents the percentage of events where the null hypothesis of equality is rejected at the 5 per cent level of significance, the third (fourth) line presents the mean benchmark (pre-event) option trading volume in logarithmic terms, the last line presents the average absolute *t*-statistic for the null hypothesis of equality between pre-event and benchmark volume.

The results for the US full sample in Table 1 for the (−141 to −41) benchmark period show that for positive shocks and for the 10-day period before the price shock (Panel A1) in 69.78 per cent (64.01 per cent) of events the call (put) option trading volume before the shock is higher than the benchmark trading volume. For 35.16 per cent (31.87 per cent) of the price shocks, the null hypothesis of equality between the pre-event and benchmark option trading volume is rejected for call (put) contracts at the 5 per cent level of significance. The results are similar for negative shocks and the rest of the pre-event periods with a tendency to increase in magnitude as the pre-event period increases. For example, in Panel A3 for 46.15 per cent (41.21 per cent) of the positive price shocks the null hypothesis of equality between the pre-event and benchmark option trading volume is rejected for call (put) contracts at the 5 per cent level of significance.

The results for the UK full sample in Table 2 for the (−141 to −41) benchmark period show that for positive shocks and for the 10-day period before the price shock in 51.05 per cent (53.41 per cent) of events the call (put) option trading volume before the shock is higher than the benchmark trading volume. For 19.28 per cent (23.23 per cent) of the price shocks, the null hypothesis of equality between the pre-event and benchmark option trading volume is rejected for call (put) contracts at the 5 per cent level of significance. The picture that emerges from the full sample results is that for a large number of stock price shocks there is irregular option trading volume *before* the shock in both markets, although this effect is more pronounced in the United States. More specifically, the null hypothesis of trading volume equality between pre-event and benchmark period is rejected irresepective of the testing period specifications. For the United States, the number of shocks with irregular trading volume before the event varies between 31.87 per cent and 46.15 per cent, whereas for the United Kingdom it varies between 18.89 per cent and 29.46 per cent.

Tables 3 and 4 report the same results for the B/M sub-samples for the US and UK market, respectively. In order to save space we only report results for the (−161 to −41) benchmark period and for only the 10-day and 30-day pre-event period. We do not report results for the market capitalisation sub-samples, since they are qualitatively the same as the reported results on B/M sub-samples (all unreported results are available upon request). Note that the results are similar to the findings for the full sample for both markets, and that the effect is less pronounced in the United Kingdom: for the United States, the number of shocks with irregular trading volume before the event varies between 31.91 per cent and 57.50 per cent, whereas for the United Kingdom it varies between 9.09 per cent and 29.69 per cent.

Table 3: Abnormal option trading volume before price shocks: B/M sort, benchmark period (161–41) days, US stocks

	Panel A: Pre-event period 10 days				*Panel B: Pre-event period 30 days*			
	Positive shocks		*Negative shocks*		*Positive shocks*		*Negative shocks*	
	Call	*Put*	*Call*	*Put*	*Call*	*Put*	*Call*	*Put*
High B/M stocks								
Percentage of: $V_p > V_b$	76.25	72.50	66.67	64.86	71.25	56.25	57.66	53.15
Reject Hypothesis 0 at 5 per cent	50.00	35.00	39.64	33.33	57.50	43.75	39.64	32.43
Mean V_b	7.39	6.90	7.54	7.03	7.39	6.90	7.54	7.03
Mean V_p	7.81	7.17	7.84	7.31	7.65	7.00	7.68	7.07
Mean abs *t* stat	2.07	1.77	1.86	1.70	2.69	2.23	2.00	1.82
Medium B/M stocks								
Percentage of: $V_p > V_b$	73.62	68.71	67.19	63.64	64.42	58.90	61.66	50.20
Reject Hypothesis 0 at 5 per cent	34.36	33.13	33.20	32.41	43.56	46.63	33.60	41.11
Mean V_b	7.27	6.82	7.34	6.88	7.27	6.82	7.34	6.88
Mean V_p	7.64	7.09	7.60	7.10	7.47	6.94	7.46	6.91
Mean abs *t* stat	1.80	1.72	1.67	1.75	2.30	2.24	1.87	2.08
Low B/M stocks								
Hypothesis 0 of: $V_p > V_b$	65.96	56.38	64.06	64.06	57.45	46.81	59.38	51.56
Reject Hypothesis 0 at 5 per cent	31.91	31.91	42.19	38.28	48.94	46.81	50.00	51.56
Mean V_b	7.11	6.63	7.28	6.78	7.11	6.63	7.28	6.78
Mean V_p	7.42	6.88	7.64	7.07	7.32	6.70	7.50	6.88
Mean abs *t* stat	1.81	1.72	1.98	1.81	2.31	2.21	2.33	2.25

Notes: The null hypothesis (Hypothesis 0) is that: $[V_b = V_p]$, that is, the pre-event option volume is equal to the benchmark period volume. The percentage in the line denoted as 'Reject Hypothesis 0 at 5 per cent' is the percentage of events for which the null is rejected at the 5 per cent of significance. There are 80 (111) positive (negative) shocks in the sample. Mean volume (V) is defined as ln(1+number of call (put) contracts of index i traded on day t). 'Mean V_b' is the mean volume for the benchmark period across all events. 'Mean V_p' is the mean volume for pre-event period across all events. 'Mean abs *t* stat ' is the absolute mean *t*-statistics for the (Hypothesis 0).

Table 4: Abnormal option trading volume before price shocks: B/M sort, benchmark period (161–41) days, UK stocks

	Panel A: Pre-event period 10 days				*Panel B: Pre-event period 30 days*			
	Positive shocks		*Negative shocks*		*Positive shocks*		*Negative shocks*	
	Call	*Put*	*Call*	*Put*	*Call*	*Put*	*Call*	*Put*
High B/M stocks								
Percentage of: $V_p > V_b$	51.56	54.69	50.00	53.93	53.13	46.88	51.56	49.44
Reject Hypothesis 0 at 5 per cent	29.69	29.69	32.81	17.98	29.69	23.44	29.69	25.84
Mean V_b	3.21	3.34	6.55	3.21	3.21	3.34	6.55	3.21
Mean V_p	3.28	3.48	6.76	3.36	3.12	3.27	6.39	3.2
Mean abs *t* stat	1.34	1.44	1.51	1.18	1.63	1.59	1.74	1.54
Medium B/M stocks								
Percentage of: $V_p > V_b$	58.33	64.39	63.64	55.84	59.09	65.91	64.39	51.30
Reject Hypothesis 0 at 5 per cent	18.94	18.94	22.73	18.83	28.79	33.33	31.06	24.03
Mean V_b	2.40	2.37	4.77	2.48	2.40	2.37	4.77	2.48
Mean V_p	2.59	2.7	5.3	2.66	2.49	2.58	5.08	2.52
Mean abs *t* stat	1.24	1.29	1.4	1.11	1.38	1.49	1.57	1.37
Low B/M stocks								
Percentage of: $V_p > V_b$	56.82	54.55	54.55	56.72	43.18	38.64	43.18	56.72
Reject Hypothesis 0 at 5 per cent	18.18	15.91	18.18	14.93	9.09	11.36	9.09	25.37
Mean V_b	3.29	3.19	6.48	3.42	3.29	3.19	6.48	3.42
Mean V_p	3.43	3.29	6.72	3.52	3.21	3.08	6.28	3.42
Mean abs *t* stat	1.27	1.04	1.21	1.11	1.13	0.93	1.10	1.36

Notes: The null hypothesis (Hypothesis 0) is that: $[V_b = V_p]$, that is, the pre-event option volume is equal to the benchmark period volume. The percentage in the line denoted as 'Reject Hypothesis 0 at 5 per cent' is the percentage of events for which the null is rejected at the 5 per cent of significance. There are 64 (89) positive (negative) shocks in the sample. Mean volume (V) is defined as ln(1+number of call (put) contracts of index i traded on day t). 'Mean V_b' is the mean volume for the benchmark period across all events. 'Mean V_p' is the mean volume for pre-event period across all events. 'Mean abs *t* stat ' is the absolute mean *t*-statistics for the (Hypothesis 0).

CONCLUSION

This article reports that for a large number of significant price changes in the underlying stock there is irregular option trading volume *before* the event; this activity is less pronounced for UK stocks. For example, while for US stocks we find that for approximately 30–50 per cent of price shocks there is abnormal option trading volume, for UK stocks this percentage ranges between 9 and 30 per cent. The finding of a much lower irregular trading in the United Kingdom indicates that regulatory differences between the two markets may lead to different investor behaviour.

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NOTE

1 The S&P 100 index includes 100 leading US stocks with exchange-listed options and a market capitalisation of around US$7.5 billion (approximately 45 per cent of the US equity market; www.standardandpoors.com), whereas the FTSE 100 includes UK stocks with the highest market capitalisation (approximately 80 per cent of the UK total equity market capitalisation; www.ftse.com).

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