Table 1. OLS market model; LS_{OLS}

Average and standard deviation; % negatives; t-ratios and a Z-statistic

PANEL A: Selling firm sample

	LS_{OLS}								
	Alfa	Beta	E-10+10	E-1+20	E-10+1	E-1+2	E-40+0	E-1+40	E-40+40
Average	0.0051	0.7161	0.1921	0.3024	0.1819	0.0856	-0.0007	0.0725	0.0341
Std. error	0.0157	0.0210	0.0663	0.0703	0.0911	0.1164	0.0537	0.0492	0.0399
Negatives	49.59 %	9.51 %	33.70 %	30.43 %	41.30 %	45.65 %	46.74 %	48.91 %	47.83 %
T-ratio	0.3264	34.1584	2.8992	4.3047	1.9959	0.7358	-0.0122	1.4735	0.8560
Z-statistic	-0.0782	-7.7672	-3.1277	-3.7533	-2.0851	-0.8341	-0.6255	-0.2085	-0.4170

PANEL B: Acquiring firm sample

	LS_{OLS}								
	Alfa	Beta	E-10+10	E-1+20	E-10+1	E-1+2	E-40+0	E-1+40	E-40+40
Average	0.0345	0.8803	0.0617	0.0297	0.0454	0.1644	-0.0178	0.0005	-0.0146
Std. error	0.1822	0.3881	0.4747	0.4494	0.7958	1.3515	0.3780	0.3627	0.3009
Negatives	40.8 %	1.77 %	47.5 %	50.7 %	50.7 %	45.0 %	53.9 %	50.0 %	51.4 %
T-ratio	2.5335	82.1495	1.4916	0.6978	0.7954	1.9868	-0.6326	0.0160	-0.6221
Z-statistic	-3.0966	-16.197	-0.8337	0.2382	0.2382	-1.9674	1.3101	0.0000	0.4764

E-10+10 = Event period dummy from day –10 to day +10 relative to announcement date
E-1+20 = Event period dummy from day –1 to day +20 relative to announcement date
E-10+1 = Event period dummy from day –10 to day +1 relative to announcement date
E-1+2 = Event period dummy for day –1 to day +2 relative to announcement date
E-40+0 = Event period dummy for day –40 to day +0 relative to announcement date
E-1+40 = Event period dummy for day –1 to day +40 relative to announcement date
E-40+40 = Event period dummy for day –40 to day +40 relative to announcement date

Table 2. Bivariate ARMA (0,q) - GARCH (m,n) model; ML_{MGRCH}**
Average and standard deviation; % negatives; t-ratios and a Z-statistic

PANEL A: Selling firm sample*

	ML_{MGRCH}								
	Alfa	Beta	E-10+10	E-1+20	E-10+1	E-1+2	E-40+0	E-1+40	E-40+40
Average	-0.06940	0.96153	0.17451	0.26276	0.22254	0.12254	0.02254	0.22420	0.02542
Std. error	0.01992	0.04324	0.09045	0.06033	0.21833	0.13046	0.03049	0.05416	0.01062
Negatives	65.94 %	9.42 %	46.74 %	34.78 %	50.00 %	51.50 %	51.00 %	37.50 %	43.50 %
T-ratio	-3.48342	22.2373	1.92935	4.35576	1.01928	0.93928	0.73928	4.13928	2.39277
Z-statistic	3.05821	-7.78454	-0.62554	-2.91920	0.00000	-0.42515	-0.25150	-2.51500	-1.95234

PANEL B: Acquiring firm sample*

	ML_{MGRCH}								
	Alfa	Beta	E-10+10	E-1+20	E-10+1	E-1+2	E-40+0	E-1+40	E-40+40
Average	-0.0032	0.8368	0.0614	0.0750	0.0794	0.2088	-0.0164	-0.0036	0.0025
Std. error	0.1880	0.4180	0.6350	0.5965	0.7303	1.8050	0.4353	0.5277	0.4066
Negatives	50.00 %	1.77 %	45.04 %	46.81 %	47.52 %	46.10 %	52.84 %	49.29 %	53.90 %
T-ratio	-0.2082	80.7296	1.6193	1.5504	1.4382	1.5850	-0.5341	-0.1096	0.0736
Z-statistic	0.0000	-16.1974	-1.6674	-1.0719	-0.8337	-1.3101	0.9528	-0.2382	1.3101

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* See Table 1 for event period specification
** The ARMA(0,q) and GARCH(m,n) are based on the BIC (Schwarz et al., 1978) for the raw returns and the squared residuals, of individual assets and index, respectively.

Table 3. Propotion misspecification

Panel A. ARMA-GARCH proportion model misspecifications

	Q(6)	$Q^2(6)$	ARCH(6)	RESET(12;6)	BDS m=2	BDS m=3
Selling Firms	0.075269	0.075269	0.075269	0.0752688	0.075269	0.075269
Acquiring Firms	0.032051	0.044872	0.044872	0.025641	0.076923	0.089744

Panel B. OLS proportion model misspecifications

	Q(6)	$Q^2(6)$	ARCH(6)	RESET(12;6)	BDS m=2	BDS m=3
Selling Firms	0.763441	0.817204	0.817204	0.5376344	0.913978	0.924731
Acquiring Firms	0.717949	0.801282	0.801282	0.5128205	0.865385	0.884615

Panel C. Z-test (5%) for Proportion misspecification in OLS - ARMA-GARCH <= 0

Z-test Selling Firms	9.509929	10.17766	10.17766	6.8390006	11.43914	11.58512
Z-test Acquiring Firms	12.51269	13.52185	13.52185	9.70027	13.95024	14.04485

$$Z_{5\%} = \frac{\begin{pmatrix} difference\ \ in \\ observed\ \ proportions \end{pmatrix} - \begin{pmatrix} difference\ \ between\ \ proportions \\ under\ \ the\ \ null\ \ hypothesis \end{pmatrix}}{Estimated\ \ standard\ \ error\ \ of\ \ the\ \ differences}$$

We assume independent samples for the Z test statistic. Q(6) : Ljung and Box (1976) statistic for serial correlation up to lag 6; $Q^2(6)$: serial correlation for squared series up to lag 6. ARCH (6) : a test for conditional heteroscedasticity in returns. Low {.} indicates significant values. RESET (12,6) : A sensitivity test for mainly linearity in the mean equation. 12 is number of lags and 6 is the number of moments that is chosen in our implementation of the test statistic.$T \cdot R^2$ is χ^2 distributed with 12 degrees of freedom. BDS (m=2,ε=1): A test statistic for general non-linearity in a time series. The test statistic BDS =$T^{1/2}.[C_m(\sigma \cdot \varepsilon) - C_1(\sigma \cdot \varepsilon)^m]$, where *C* is based on the correlation-integral, m is the dimension and ε is the number of standard deviations. Under the null hypothesis of identically and independently distributed (i.i.d.) series, the BDS-test statistic is asymptotic normally distributed with a zero mean and with a known but complicated variance.

Table 4. Abnormal Returns (AR) using the OLS Market Model (LS_{OLS}), the multivariate GARCH Market Model (ML_{MGRCH}).

	Selling Firms Cumulative Abnormal Return (CAR)				Acquiring Firms Cumulative Abnormal Return (CAR)			
Day	LS_{OLS}		ML_{MGRCH}		LS_{OLS}		ML_{MGRCH}	
-40	0.00000	{0.000}	0.00000	{0.000}	0.16965	{0.127}	0.17973	{0.930}
-39	0.42819	{1.214}	0.57447	{1.621}	-0.12929	-{0.507}	-0.09027	{0.020}
-38	0.02293	-{0.173}	0.11285	{0.024}	-0.13891	-{0.003}	-0.03748	{0.581}
-37	-0.20910	-{0.517}	-0.02695	-{0.271}	-0.11055	-{0.079}	0.03239	{0.688}
-36	-0.89726	-{1.826} *	-0.50693	-{1.254}	-0.17866	-{0.071}	0.03759	{0.757}
-35	-0.64033	-{1.344}	-0.23829	-{0.868}	-0.21996	-{0.367}	0.05550	{0.500}
-34	-0.71378	-{1.292}	-0.22449	-{0.726}	-0.35039	-{0.456}	-0.03781	{0.387}
-33	-0.68290	-{1.420}	-0.16644	-{0.846}	-0.76499	-{1.186}	-0.40237	-{0.322}
-32	-0.59185	-{1.311}	0.11427	-{0.599}	-0.78561	-{0.980}	-0.33573	-{0.044}
-31	-0.51038	-{1.083}	0.36538	-{0.302}	-0.62281	-{0.563}	-0.10217	{0.459}
-30	-0.70453	-{1.086}	0.15019	-{0.385}	-0.63110	-{0.609}	-0.02408	{0.512}
-29	-0.21039	-{0.499}	0.81172	{0.245}	-0.67623	-{0.867}	0.00540	{0.369}
-28	-0.47162	-{0.782}	0.74089	{0.055}	-0.77898	-{1.168}	0.01174	{0.218}
-27	-0.63615	-{0.958}	0.51446	-{0.177}	-0.92650	-{1.202}	-0.08155	{0.241}
-26	-0.35937	-{0.742}	0.71917	-{0.050}	-0.66813	-{0.919}	0.24677	{0.595}
-25	-0.58171	-{0.967}	0.47662	-{0.326}	-0.55119	-{0.689}	0.46696	{0.927}
-24	-0.19039	-{0.647}	0.96151	{0.042}	-0.74607	-{0.827}	0.36347	{0.843}
-23	-0.13441	-{0.361}	1.24310	{0.438}	-0.76562	-{0.927}	0.41818	{0.796}
-22	-1.13505	-{0.983}	0.34378	-{0.144}	-1.00515	-{1.028}	0.19594	{0.640}
-21	-0.90528	-{0.767}	0.65181	{0.082}	-0.96916	-{0.983}	0.29972	{0.707}
-20	-0.68591	-{0.638}	0.94474	{0.231}	-1.00327	-{1.093}	0.29602	{0.586}
-19	-0.93168	-{0.836}	0.77523	{0.118}	-0.94396	-{1.105}	0.43279	{0.649}
-18	-1.56228	-{1.347}	0.13260	-{0.393}	-1.30459	-{1.561}	0.19934	{0.293}
-17	-1.17901	-{1.089}	0.56389	-{0.145}	-0.86536	-{0.953}	0.66047	{0.885}
-16	-1.15651	-{1.094}	0.76628	-{0.077}	-1.13340	-{1.269}	0.46351	{0.601}
-15	-1.44987	-{1.276}	0.52805	-{0.260}	-1.11691	-{1.154}	0.55848	{0.760}
-14	-0.99954	-{0.975}	1.14971	{0.105}	-1.12351	-{1.328}	0.66765	{0.676}
-13	-0.85817	-{0.854}	1.35733	{0.252}	-1.26055	-{1.521}	0.59638	{0.534}
-12	-0.80351	-{0.831}	1.48177	{0.303}	-1.48674	-{1.855} *	0.39783	{0.179}
-11	-1.26386	-{1.119}	1.09998	{0.043}	-1.28166	-{1.510}	0.69385	{0.609}
-10	-1.31036	-{1.070}	1.15850	{0.093}	-1.19942	-{1.267}	0.85823	{0.891}
-9	-0.90027	-{0.850}	1.77681	{0.413}	-1.02783	-{1.016}	1.09918	{1.150}
-8	-0.77698	-{0.721}	1.98800	{0.601}	-0.84463	-{0.739}	1.35697	{1.441}
-7	-0.21117	-{0.341}	2.61497	{0.991}	-1.03121	-{0.861}	1.22735	{1.312}
-6	0.05907	-{0.144}	2.99488	{1.204}	-1.24157	-{1.036}	0.99421	{1.099}
-5	0.15442	{0.014}	3.25444	{1.446}	-0.94874	-{0.889}	1.39555	{1.302}
-4	0.22943	{0.039}	3.39399	{1.501}	-1.03015	-{1.024}	1.37310	{1.208}
-3	0.19264	-{0.112}	3.41982	{1.370}	-0.95270	-{0.815}	1.51770	{1.458}
-2	-0.18775	-{0.379}	3.10980	{1.119}	-1.06376	-{0.908}	1.47273	{1.378}
-1	0.16800	-{0.199}	3.55716	{1.313}	-1.01542	-{0.872}	1.57438	{1.426}
0	0.16987	-{0.144}	3.56104	{1.320}	-0.75075	-{0.495}	1.88123	{1.788} *
1	0.33633	{0.004}	3.76301	{1.458}	-0.64778	-{0.389}	2.00307	{1.863} *
2	0.31225	-{0.030}	3.83745	{1.439}	-0.35965	-{0.103}	2.33990	{2.145} **
3	0.28730	-{0.003}	3.87725	{1.502}	-0.46286	-{0.150}	2.27242	{2.100} **
4	1.02326	{0.321}	4.69886	{1.817} *	-0.51034	-{0.325}	2.28190	{1.939} *
5	0.86021	{0.289}	4.65876	{1.810} *	-0.63270	-{0.391}	2.25598	{1.925} *
6	1.23393	{0.533}	5.13421	{2.110} **	-0.59185	-{0.498}	2.35199	{1.849} *
7	1.66925	{0.853}	5.62716	{2.455} ***	-0.67559	-{0.575}	2.31082	{1.772} *
8	1.89827	{0.938}	5.92523	{2.572} ***	-0.23183	-{0.248}	2.81870	{2.141} **
9	2.19598	{1.007}	6.26365	{2.640} ***	-0.24220	-{0.345}	2.85830	{2.054} **
10	2.59077	{1.184}	6.71335	{2.776} ***	-0.12621	-{0.273}	3.00546	{2.121} **
11	2.55363	{1.237}	6.97375	{2.913} ***	-0.19560	-{0.284}	2.95034	{2.063} **
12	2.73988	{1.291}	7.18857	{2.955} ***	-0.18447	-{0.249}	3.02377	{2.118} **
13	3.60589	{1.745} *	8.13660	{3.417} ***	-0.12044	-{0.290}	3.13741	{2.096} **
14	4.76830	{2.363} ***	9.39837	{4.042} ***	-0.22339	-{0.264}	3.10396	{2.163} **
15	5.81759	{2.830} ***	10.51735	{4.527} ***	-0.11822	-{0.046}	3.25423	{2.394} ***
16	5.77935	{2.719} ***	10.59567	{4.485} ***	-0.10409	{0.075}	3.31472	{2.556} ***
17	5.61136	{2.601} ***	10.53753	{4.412} ***	-0.23041	-{0.130}	3.24163	{2.384} ***
18	5.87677	{2.690} ***	10.93715	{4.530} ***	-0.48272	-{0.296}	3.05912	{2.247} **
19	6.17723	{2.801} ***	11.30717	{4.658} ***	-0.41032	-{0.241}	3.18641	{2.315} **
20	6.09606	{2.656} ***	11.36236	{4.553} ***	-0.54416	-{0.465}	3.12636	{2.126} **
21	6.05456	{2.522} ***	11.40812	{4.439} ***	-0.35833	-{0.313}	3.37839	{2.300} **
22	5.80954	{2.358} ***	11.29849	{4.308} ***	-0.27276	-{0.235}	3.50595	{2.387} ***
23	5.15843	{2.057} **	10.69073	{4.017} ***	-0.29714	-{0.212}	3.52661	{2.431} ***
24	5.11288	{1.955} *	10.79615	{3.952} ***	-0.38335	-{0.262}	3.49752	{2.384} ***
25	4.79435	{1.740} *	10.59781	{3.750} ***	-0.53681	-{0.388}	3.37368	{2.248} **
26	4.81946	{1.809} *	10.71709	{3.820} ***	-0.68293	-{0.474}	3.26995	{2.167} **
27	4.74976	{1.764} *	10.75690	{3.803} ***	-0.44982	-{0.375}	3.51715	{2.242} **
28	4.71729	{1.724} *	10.83465	{3.800} ***	-0.39650	-{0.316}	3.63560	{2.322} **
29	4.51309	{1.606}	10.69189	{3.714} ***	-0.57105	-{0.458}	3.51882	{2.217} **
30	4.00887	{1.356}	10.14892	{3.447} ***	-0.45197	-{0.340}	3.74627	{2.400} ***
31	3.70439	{1.305}	9.98180	{3.438} ***	-0.55516	-{0.468}	3.69034	{2.282} **
32	3.76697	{1.337}	10.26656	{3.542} ***	-0.82693	-{0.686}	3.48009	{2.095} **
33	3.80634	{1.404}	10.24768	{3.563} ***	-0.93317	-{0.748}	3.43794	{2.077} **
34	3.52383	{1.236}	9.94577	{3.367} ***	-1.12500	-{0.838}	3.33268	{2.034} **
35	3.54727	{1.268}	10.01144	{3.376} ***	-1.17919	-{0.813}	3.37733	{2.097} **
36	3.17436	{1.058}	9.78425	{3.221} ***	-1.42014	-{1.048}	3.19034	{1.902} *
37	2.93134	{0.971}	9.72053	{3.209} ***	-1.52329	-{1.082}	3.16211	{1.916} *
38	2.78957	{0.825}	9.62165	{3.089} ***	-1.60822	-{1.161}	3.12442	{1.868} *
39	2.41418	{0.691}	9.21175	{2.949} ***	-1.68499	-{1.047}	3.15441	{2.048} **

Table 5. CARs and t-statistics for Various Intervals.

	Selling Firms				Acquiring Firms			
	LS_{OLS}		ML_{MGRCH}		LS_{OLS}		ML_{MGRCH}	
Period	CAR	Z-statistic	CAR	Z-statistic	CAR	Z-statistic	CAR	Z-statistic
40, + 40	2.41418	{0.691}	9.21175	{2.949} ***	-1.44725	-{0.877}	3.47045	{2.252} **
- 40, + 0	0.16987	-{0.144}	3.56104	{1.320}	-0.75075	-{0.495}	1.57438	{1.426}
- 20, + 0	1.07514	{0.531}	2.90923	{1.744} *	0.21842	{0.267}	1.27465	{1.309}
- 10, - 1	1.49329	{2.365} ***	2.45718	{2.520} ***	0.25151	{0.772}	0.77889	{1.518}
- 5, + 5	0.80114	{0.838}	1.66388	{1.546}	0.60888	{1.049}	1.28769	{1.782} *
- 5, + -1	-0.24683	-{0.749}	0.56228	{0.529}	0.17782	{0.230}	0.47852	{1.052}
- 1, + 2	0.35762	{1.012}	0.65321	{1.407}	0.70411	{2.499} ***	0.86717	{2.732} ***
- 0, + 2	0.52409	{1.364}	0.45125	{1.023}	0.65577	{2.794} ***	0.76552	{2.916} ***
- 1, + 20	6.36498	{5.205} ***	8.25256	{6.048} ***	0.65344	{0.829}	1.71368	{2.036} **
- 1, + 40	2.60193	{1.325}	6.10196	{6.097} ***	-0.38350	-{0.343}	1.65169	{2.380} ***
20, + 40	-3.76305	-{3.437} ***	-2.09542	-{2.140} **	-1.03694	-{1.315}	-0.06199	-{0.306}