“Shareholders wealth and mergers and acquisitions (M&As)”

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SHAREHOLDERS WEALTH AND MERGERS AND ACQUISITIONS (M&As)

Abstract

We re-examine the abnormal returns (ARs) around merger announcements using a large sample of 8,945 announcements. We estimate the ARs using the Carhart (1997) four-factor model under the standard ordinary least square (OLS) method and the Glosten et al.'s (1993) asymmetric GARCH specification (hereafter, GJR-GARCH). Under the OLS method, acquirers do not generate significant cumulative ARs (CARs) in line with prior work. Our new results, however, show that under the GJR-GARCH estimation, acquirers generate positive and significant cumulative CARs. We attribute the gains to the use of the GJR-GARCH estimation method, as the GJR-GARCH method is more effective in capturing conditional volatility and asymmetry in the excess returns.

Keywords mergers and acquisitions (M&As), abnormal returns (ARs), shareholders wealth, GJR-GARCH

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INTRODUCTION

There is no doubt that the area of mergers and acquisitions (M&As) has been heavily researched[1]. However, the empirical findings are not always consistent. To date, accounting and finance researchers provide definitive answers on the economic gain arising from M&As deals. For example, the finance literature indicates that acquirers' abnormal returns (ARs) around merger announcements are either zero or negative and significant (Campa & Hernando, 2006; Dutta & Jog, 2009; Stunda, 2014). These results hold fairly consistent, except when targets are unlisted (Faccio et al., 2006; Fuller et al., 2002). Only targets tend to consistently generate positive ARs (Goergen & Renneboog, 2004). The empirical results are mixed in accounting research[2]. The economic question is: Why do acquirers undertake M&As deals that do not generate gains to their shareholders?

This paper focuses on the estimation issues around the determination of the ARs. How the ARs are estimated is important as it affects inferences about the gains to shareholders in M&As deals. Using the bid price observed in capital markets is the most appropriate measure of the gains to shareholders (Grinblatt & Titman, 2002). This is because

1 There are a number of review studies in the areas that take on different perspectives. For example, Haleblian et al. (2009) consolidate the materials from management, economics, finance, accounting and sociology. Tuch and O'Sullivan (2007) review short- and long-run performance of firms engaged in M&As deals. Napier (1989) reviews the materials from a human resource perspective.

2 Aslinger and Copeland (1996) find increases in acquires' value of 14.3% above the S&P 500 index (see also Savor and Lu, 2009; Martynova et al., 2007). However, Sharma and Ho (2002) report that M&As have an insignificant effect on the adjusted operating performance of firms. Bild et al. (2002) also conclude that up to 30% of the pre-acquisition value of U.K. firms is destroyed following the completion of M&As (see also Dickerson et al., 1997).

managers and executives have less control over capital markets, thereby causing market valuations to be more representative of true value[3]. Uncertainty about both the acquirer and target prices can dictate the form of payments, which, in turn, can affect the ARs. Myers and Majluf (1984) indicate that a share exchange occurs if acquirers believe that their shares are overvalued. Thus, adverse selection on the part of acquirers could lead to an exchange of acquirer's own stocks with targets, so that target shareholders share the risk of overpayment (Eckbo & Thorburn, 2000).

The next section briefly discusses the theories underpinning mergers and acquisitions deals and relates them to existing evidence. Sections 2 discuss the methodologies in prior work. Section 3 presents our data and research methodology. Section 4 presents empirical results and we conclude in the final section.

1. REVIEW OF PRIOR WORK

Economies of scale and cost effectiveness – The motives for M&As often include a desire to achievement economies of scale and greater cost effectiveness. Reynolds and Teerikangas (2016) suggest that firms use M&As for strategic expansion and to develop new competences and capabilities. Finance theory suggests that M&As take place to increase shareholders' wealth and take over control of poor performing firms. So, M&As will take place in efficient markets under rational conditions. Empirical studies show that acquirer shareholders do not gain in M&As deals. Acquirers' ARs tend to be negative (Chatterjee, 2011; Alexandridis et al., 2010)[4]. The exception is when acquirers bid for non-listed targets (see Faccio et al., 2006; Fuller et al., 2002)[5]. While these studies do not necessarily emphasize the economies of scale and cost effectiveness motive for mergers, the general result is that the acquirers' ARs are not positive. In contrast, most empirical studies document positive ARs for targets (Fuller et al., 2002), suggesting that all of the gains go to target shareholders.

Economic impact of mergers and acquisitions – The economic impact of M&As is significant as they affect several interest groups, i.e., employees and creditors. Studies that investigate the economic and social effects of mergers suggest that M&As have prolong negative repercussions due to lay-offs following mergers (Blonigen & Pierce, 2016). M&As can also lead to excessive market concentration and contribute to price increases and reduction in consumer welfare (Carletti et al., 2015). Other studies suggest that restructuring following M&As help safeguard the workforce of targets (see Inoue et al., 2010). Other studies suggest that M&As enhance operational efficiency of firms (Carline et al., 2009).

Synergy motive – Synergy theory suggests that M&As take place due to the economic benefits of unification following mergers. Dutordoir et al. (2014) report that disclosing synergy forecasts prior to mergers leads to an increase in returns. M&As also take place to exploit financial (Leland, 2007) and operational (Lewis & Webb, 2007) synergies.

2. EMPIRICAL MODELS, ESTIMATION METHODS, AND TESTS OF STATISTICAL SIGNIFICANCE

Empirical models of the ARs – Essentially, a well-specified benchmark model is needed to generate the ARs. Fama and French (1996) state that the choice of benchmark model can have important implications

3 The argument relies on rational behavior and market efficiency. However, stock prices around M&As announcements can be mis-priced (Shleifer & Vishny, 2003; Bi & Gregory, 2011). From an accounting perspective, both acquirers and targets can manipulate their earnings (see Erickson & Wang, 1999), and/or institute conditions that enhance their valuations. Besides the target price, a lot of the discretionary accounting items at the point of revaluation and consolidation are under the control of managers.

4 This is a fairly consistent result, although Wong et al. (2009) report positive ARs for acquirers of Asian countries. In addition, Dutta and Jog (2009) and Dutta et al. (2013) report positive ARs for acquirers in cross-border studies. The latter result can occur if information asymmetry exists across markets.

5 These exceptions are studies that examine acquirer returns when targets are private and/or not listed. These studies report positive ARs for acquires (see Faccio et al., 2006; Fuller et al., 2002). It is useful to acknowledge that private and/or unlisted targets do not have market valuations or reference points. Thus, they may be undervalued. Similarly, asymmetric information is more pronounced in capital markets when targets are not listed.

for the size of ARs. Several different model specifications are used in empirical work, including: (i) the market model (see Goergen & Renneboog, 2004); (ii) the adjusted market return (Faccio et al., 2006; Alexandridis et al., 2010); and (iii) the Fama and French (1993) three factor model (Gregory, 1997; Kothari & Warner, 1997; Draper & Paudyal, 2006). We use the Carhart (1997) four-factor model since it appears to improve the specification of the Fama and French (1993) three-factor model.

Estimation methods of the ARs – Prior studies typically use linear estimation methods, including the standard OLS to generate the ARs (Alexandridis et al., 2010). Periods around mergers are very volatile, which can in turn affect the estimated predicted values associated with the ARs. Thus, using linear estimation methods will generate inefficient parameter estimates. The GARCH-type estimation methods are more appropriate since they capture the conditional volatility and asymmetry in the ARs (Baillie & Bollerslev, 1989). In this study, we estimate both the standard OLS and the asymmetric GARCH of Glosten et al. (1993) (hereafter GJR-GARCH) as a way of illustrating this issue.

Tests of statistical significance – The volatility clustering in the ARs can lead to overrejection of the null hypothesis of zero ARs. Several statistical tests have been put forward to deal with this problem (Boehner et al., 1991). Kolari and Pynnonen (2010) modify the Boehner et al.'s (1991) *t*-statistic (hereafter, the BMP *t*-statistic) to reduce the effects of event-induced volatility and cross-correlation. Thus, we use this test in our analysis.

3. DATA AND METHODOLOGY

3.1. Sample selection and descriptive statistics

We identify US M&As using the Thomson Financial Securities Data Company's (SDC) Database over the period January 1, 1991 to December 31, 2013. Similar to Moeller et al. (2005), we require that: (i) each merger announcement leads to successful completion and that there are less than 1,000 days between the announcement and completion; (ii) the deal value is one million dollars or more and the deal value relative to the market capitalization of acquirer is more than 1%; (iii) the acquirer is publicly quoted nonfinancial U.S. firm listed on the NYSE, AMEX, or NASDAQ; (iv) the acquirer also has financial and accounting data on the Center for Research in Security Prices (CRSP) and Compustat databases; (v) the target is a U.S. public or private nonfinancial firm; and (vi) the acquirer controls less than 50% of shares of the target at the announcement day, but ends up with 100% on completion.

Following Chang (1998), we include only firms with M&As announcements in the event window. We exclude acquirers with stock prices below two dollars at the announcement date. Our final sample comprises 8,945 successful M&As made by 2,970 acquirers. Following Martin (1996) and Fuller et al. (2002), the sample is divided according to the payment methods: (i) cash payment including combinations of cash, debt, and liabilities; (ii) stock payment including common stock and combination of common stock, options or warrants; and (iii) mixed payment including combinations of common stock, cash, debt, preferred stock, convertible securities.

The descriptive statistics for the market capitalization of acquirers and deal value in each announcement year are shown in Table 1. The mean market capitalization of acquirers is 2.86 billion dollars; the mean deal value is 309.34 million dollars. The market capitalization value and the deal value in the 2000s are larger than those in the 1990s. Of the 8,945 successful mergers, 3,280 (36.67%) are made by cash payment, 1,278 (14.29%) are made by stock payment, and the rest of 4,387 (49.04%) are made by mixed payment.

3.2. Methodology

To capture the ARs, we first estimate the Carhart (1997) four-factor model over the estimation-window $(t-240,\ t-6)$ relative to the merger announcement date t, thus:

$$(R_{i,t} - R_{f,t}) = \alpha_i + \beta_i \left(R_{m,t} - R_{f,t}\right) + \\ + s_i SMB_t + h_i HML_t + m_i MOM_t + \varepsilon_{i,t}, \quad (1)$$

where $R_{i,t} - R_{f,t}$ denotes the excess daily return on stock i; $R_{m,t} - R_{f,t}$ denotes the value-weight-

Table 1. Descriptive statistics of M&As announced over the period 1991 to 2013

Year	Market capitalization		Deal value		Whole sample	Cash payment		Stock payment		Mixed payment	
	Mean	Median	Mean	Median	N	N	%	N	%	N	%
1991	998.96	261.65	84.02	16.66	164	34	20.73	30	18.29	100	60.98
1992	809.00	186.74	72.17	17.68	235	53	22.55	57	24.26	125	53.19
1993	756.53	195.74	77.37	18.25	328	87	26.52	67	20.43	174	53.05
1994	1,112.42	175.27	102.66	21.36	402	118	29.35	77	19.15	207	51.50
1995	1,012.94	217.45	147.86	25.33	427	110	25.76	103	24.12	214	50.12
1996	1,368.46	292.60	214.03	30.08	604	135	22.35	139	23.01	330	54.64
1997	1,184.66	302.68	149.92	27.28	734	192	26.16	136	18.53	406	55.31
1998	2,088.36	358.82	243.14	32.88	677	198	29.25	142	20.97	337	49.78
1999	4,998.87	562.05	544.51	52.50	602	141	23.42	154	25.58	307	51.00
2000	5,195.16	913.47	521.00	68.53	577	136	23.57	169	29.29	272	47.14
2001	2,821.76	607.75	501.31	50.16	358	110	30.73	56	15.64	192	53.63
2002	2,661.21	557.66	338.24	44.18	358	163	45.53	29	8.10	166	46.37
2003	2,194.27	544.32	212.03	45.28	340	145	42.65	24	7.06	171	50.29
2004	1,925.83	566.99	303.84	43.64	413	210	50.85	21	5.08	182	44.07
2005	4,017.28	576.32	478.30	47.59	407	197	48.40	17	4.18	193	47.42
2006	3,690.98	616.61	292.09	45.14	416	223	53.60	16	3.85	177	42.55
2007	4,619.02	711.67	321.66	50.49	404	201	49.75	8	1.98	195	48.27
2008	2,148.05	607.25	203.52	43.85	252	142	56.35	2	0.79	108	42.86
2009	7,166.11	611.23	784.36	44.59	206	102	49.51	13	6.31	91	44.18
2010	5,444.78	934.93	441.15	90.74	258	145	56.20	5	1.94	108	41.86
2011	4,174.26	1,072.44	447.34	82.53	268	150	55.97	2	0.75	116	43.28
2012	3,574.02	734.10	299.44	86.96	281	147	52.31	4	1.42	130	46.27
2013	3,865.62	1,142.96	424.13	113.73	234	141	60.26	7	2.99	86	36.75
1991–2000	2,231.29	325.99	251.13	31.10	4,750	1,204	25.35	1,074	22.61	2,472	52.04
2001–2010	3,506.20	611.20	372.49	47.98	3,412	1,638	48.00	191	5.60	1,583	46.40
2011–2013	3,866.61	994.41	387.33	90.48	783	438	55.94	13	1.66	332	42.40
1991–2013	2,860.74	476.74	309.34	40.16	8,945	3,280	36.67	1,278	14.29	4,387	49.04

Note: This table shows the mean and median market capitalization for acquirers and their deal values around M&A announcements. The deal value is one million dollars or more and the deal value relative to the market capitalization of the acquirer is not less than 1%. The market capitalization of the acquirer equals the share price one month previous to the merger announcement times the number of common shares outstanding. The deal value is defined as the total value of consideration paid by the acquirer, excluding fees and expenses. We adjust the market capitalization and the deal value using the annual CPI (2001 = 100), provided by the U.S. Department of Labor Bureau of Labor Statistic. The yearly mean and median values are displayed in million dollars. The acquirer is a U.S. public listed firm, while the target is a U.S. public or private firm, or its subsidiary. The stock price of acquirers is not below two dollars. The final sample is comprised of 8,945 merger announcements made by 2,970 unique acquirers.

ed daily return on a market portfolio less risk-free rate; SMB_t denotes the difference in daily returns between two portfolios comprising of large and small sized stocks; HML_t denotes the difference in daily returns between two portfolios comprising of high and low book-to-market (B/M) stocks; MOM_t denotes the difference in daily returns between two portfolios comprising of past winner and loser stocks[6]; $\varepsilon_{i,t}$ denotes the error term.

For comparison, we estimate Eq. (1) using both the GJR-GARCH and the standard OLS estimation methods. We compute the CARs over an 11-day event window $(t-5,\ t+5)$, as short window event studies provide more reliable estimates of the ARs (Andrade et al., 2001). The BMP t-statistic of $AR_{i,t}$ is given as:

$$BMP \text{ t-stat} = \frac{1}{\sqrt{N}} \sum_{i=1}^{N} \frac{SAR_{i,t}}{\hat{S}\left(SAR_t\right)}, \qquad (2)$$

6 $R_{m,t} - R_{f,t}$, SMB_t, HML_t, and MOM_t are obtained from Kenneth R. French data library: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library

Table 2. Average AR measures for acquirers and targets around merger announcements using the four-factor CAPM under the OLS method and the GJR-GARCH method

Days	OLS estimation method				GJR-GARCH estimation method			Wilcoxon signed-ranks test			
	ARs	CARs	SCARs	t-stat	ARs	CARs	SCARs	t-stat	ARs	CARs	SCARs
Panel A: Acquirers											
–5	0.178	0.178	0.977	0.13	0.352	0.352	3.763	0.51	2.44b	2.44b	5.22a
–4	0.042	0.220	2.722	0.37	0.238	0.590	8.463	1.15	5.22a	6.54a	4.59a
–3	0.306	0.526	6.837	0.93	0.490	1.080	8.160	1.10	5.68a	7.56a	5.22a
–2	0.281	0.807	8.354	1.13	0.403	1.483	10.675	1.56	4.76a	7.09a	4.91a
–1	0.108	0.915	7.060	0.95	0.269	1.752	11.982	1.66c	5.83a	8.51a	4.59a
0	0.204	0.204	4.885	0.67	0.338	0.338	12.669	1.97b	4.84a	4.84a	6.55a
1	0.349	0.349	6.247	0.85	0.523	0.523	12.061	1.76c	6.55a	7.90a	6.12a
2	–0.018	0.331	8.345	1.13	0.136	0.659	11.548	1.57	6.13a	9.20a	6.40a
3	–0.282	0.049	–6.969	–0.95	–0.088	0.571	–4.205	–0.57	7.31a	9.85a	4.91a
4	–0.156	–0.107	–5.945	–0.81	–0.001	0.570	–3.130	–0.42	6.41a	10.28a	6.83a
5	–0.040	–0.147	2.968	0.40	0.115	0.685	7.381	1.00	5.83a	11.48a	5.83a
Panel B: Targets											
–5	0.038	0.038	1.335	0.25	0.048	0.048	3.787	0.72	1.78c	1.78c	4.75a
–4	0.058	0.096	–3.483	–0.66	0.071	0.119	–0.721	–0.14	2.78a	3.00a	3.78a
–3	–0.037	0.059	–4.883	–0.93	–0.030	0.089	–3.552	–0.67	1.94c	3.72a	3.61a
–2	0.142	0.201	–0.558	–0.11	0.210	0.299	2.536	0.48	2.84a	4.13a	6.55a
–1	0.019	0.220	5.183	0.98	0.057	0.356	7.759	1.67c	2.45a	4.10a	2.40b
0	1.717	1.717	16.213	2.47b	2.473	2.473	18.138	2.87a	2.15b	2.15b	2.29b
1	0.613	0.613	12.138	2.10b	0.687	0.687	14.230	2.50b	1.95c	1.95c	4.11a
2	0.021	0.634	6.079	1.16	0.039	0.726	8.549	1.76c	2.06b	2.23b	3.94a
3	0.079	0.713	3.619	0.68	0.116	0.842	4.812	0.91	2.96a	4.10a	2.93a
4	0.003	0.716	–4.711	–0.89	0.045	0.887	–3.138	–0.60	3.69a	4.65a	2.87a
5	–0.173	0.543	–6.133	–1.16	–0.154	0.733	–4.767	–0.90	2.71a	5.12a	2.76a

Note: This table presents the ARs estimates for acquirers and targets around merger announcements using the Carhart (1997) four-factor model under the OLS and GJR-GARCH estimation methods. The adjusted BMP *t*-statistic due to Kolari and Pynnönen (2010) is used to test statistical significance. The Wilcoxon signed-ranks statistic tests for differences in the ARs over the estimation methods. a, b, and c denote the statistical significance at the 1%, 5%, and 10% levels, respectively.

where $\hat{S}(SAR_t) = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}\left(SAR_{i,t} - \overline{SAR_t}\right)^2}$;

$\overline{SAR_t} = \frac{1}{N}\sum_{i=1}^{N} SAR_{i,t}$. Here, $SAR_{i,t}$ denotes the standardized AR (SAR) for stock i at day t, while $\hat{S}(SAR_t)$ denotes the cross-sectional standard deviation of SAR at the event day t (Brown and Warner, 1985). For multi-day intervals $(T$ days$)$, the BMP t-statistic is the ratio of the average CAR to its estimated standard deviation:

$$BMP \text{ t-stat} = \sum_{t=1}^{T} \frac{CAR_T}{\sqrt{\sum_{t=1}^{T}\hat{S}^2(CAR_T)}}, \quad (3)$$

where

$$\hat{S}(CAR_T) = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}\left(CAR_{i,T} - CAR_T\right)^2}.$$

The adjusted BMP t-statistic due to Kolari and Pynnönen (2010) is given as:

$$BMP \text{ t-stat} \times \sqrt{\frac{1-\bar{r}}{1+(n-1)\bar{r}}}, \quad (4)$$

where $\sqrt{\frac{1-\bar{r}}{1+(n-1)\bar{r}}}$ is the correlation factor for the adjusted BMP t-statistic. $\bar{r}$ is the average of sample cross-correlations of estimation-period residuals.

4. EMPIRICAL RESULTS AND DISCUSSIONS

4.1. ARs for acquirers and targets

Panel A of Table 2 reports the estimated ARs. Under the OLS method, the CAR of 0.204% (p-value ≥ 0.10) is insignificant at day t. None of CARs are significant under the OLS in line with previous studies (Lang et al., 1989; Hackbarth & Morellec, 2008; Alexandridis et al., 2010). However, under the GJR-GARCH, the CARs are positive and significant (p-value ≤ 0.10) over the $t-1$ to $t+1$ window. Indeed, acquirers gain a significant CAR of 1.130% over the 3-day window under the GJR-GARCH method, while the OLS generates an insignificant CAR of 0.661% (p-value ≥ 0.10) over the $t-1$ to $t+1$ window.

Panel B of Table 2 shows the corresponding results for targets. Over the two-day window t to $t+1$, the CAR of 2.33% is positive and significant under the OLS method, corroborating prior results (Goergen & Renneboog, 2004). The GJR-GARCH still outperforms the OLS method. Here, the CARs are significant over the four-day window $t-1$ to $t+2$. The Wilcoxon signed-ranks test rejects the null hypothesis that the magnitude of the AR are similar for both estimation methods (p-value ≥ 0.05). Furthermore, Table 3 shows that using bootstrapping, the simulated CARs are similar to those estimated under the OLS and GJR-GARCH methods.

4.2. ARs and payment methods

Following Myers and Majluf (1984), high value acquirers tend to make cash payment or a large pro-

Table 3. Bootstrapping simulations of AR measures for acquirers and targets around merger announcements

Days	OLS estimation method						GJR-GARCH estimation method					
	ARs		CARs		SCARs		ARs		CARs		SCARs	
	Actual	Boot.	Actual	Boot.	Actual	Boot.	Actual	Boot.	Actual	Boot.	Actual	Boot.
Panel A: Acquirers												
–5	0.178	0.174	0.178	0.174	0.977	0.988	0.352	0.365	0.352	0.365	3.763	3.796
–4	0.042	0.044	0.220	0.218	2.722	2.703	0.238	0.243	0.590	0.608	8.463	8.416
–3	0.306	0.297	0.526	0.515	6.837	6.865	0.490	0.475	1.080	1.083	8.160	8.202
–2	0.281	0.285	0.807	0.800	8.354	8.383	0.403	0.398	1.483	1.481	10.675	10.644
–1	0.108	0.113	0.915	0.913	7.060	7.049	0.269	0.263	1.752	1.744	11.982	12.011
0	0.204	0.205	0.204	0.205	4.885	4.909	0.338	0.328	0.338	0.328	12.669	12.646
1	0.349	0.340	0.349	0.340	6.247	6.289	0.523	0.538	0.523	0.538	12.061	12.033
2	–0.018	–0.016	0.331	0.324	8.345	8.360	0.136	0.130	0.659	0.668	11.548	11.510
3	–0.282	–0.289	0.049	0.035	–6.969	–6.953	–0.088	–0.092	0.571	0.576	–4.205	–4.218
4	–0.156	–0.160	–0.107	–0.125	–5.945	–5.927	–0.001	0.001	0.570	0.577	–3.130	–3.137
5	–0.040	–0.041	–0.147	–0.166	2.968	3.042	0.115	0.120	0.685	0.697	7.381	7.351
Panel B: Targets												
–5	0.038	0.054	0.038	0.054	1.335	1.368	0.048	0.038	0.048	0.038	3.787	3.777
–4	0.058	0.074	0.096	0.128	–3.483	–3.445	0.071	0.064	0.119	0.102	–0.721	–0.735
–3	–0.037	–0.04	0.059	0.088	–4.883	–4.895	–0.030	–0.031	0.089	0.071	–3.552	–3.544
–2	0.142	0.228	0.201	0.316	–0.558	–0.561	0.210	0.215	0.299	0.286	2.536	2.563
–1	0.019	0.051	0.220	0.367	5.183	5.138	0.057	0.070	0.356	0.356	7.759	7.757
0	1.717	1.772	1.717	1.772	16.213	16.298	2.473	2.506	2.473	2.506	18.138	18.147
1	0.613	0.703	0.613	0.703	12.138	12.173	0.687	0.673	0.687	0.673	14.230	14.256
2	0.021	0.041	0.634	0.744	6.079	6.136	0.039	0.030	0.726	0.703	8.549	8.581
3	0.079	0.083	0.713	0.827	3.619	3.671	0.116	0.124	0.842	0.827	4.812	4.826
4	0.003	0.008	0.716	0.835	–4.711	–4.735	0.045	0.052	0.887	0.879	–3.138	–3.103
5	–0.173	–0.186	0.543	0.649	–6.133	–6.177	–0.154	–0.171	0.733	0.708	–4.767	–4.750

Note: This table presents the average ARs measures, i.e., ARs, CARs, and SCARs, for acquirers (in Panel A) and targets (in Panel B) around merger announcements using the Carhart (1997) four-factor model under the OLS method and the GJR-GARCH method. The corresponding simulated returns (boot.) around merger announcements are based on the nonparametric bootstrapping simulations using 1,000 runs with replacements for each estimation method.

Table 4. Average ARs measures around announcements for acquirers by payment method

Days	OLS estimation method				GJR-GARCH estimation method				Wilcoxon signed-ranks test		
	ARs	CARs	SCARs	t-stat	ARs	CARs	SCARs	t-stat	ARs	CARs	SCARs
Panel A: Cash payment											
–5	0.200	0.200	0.370	0.09	0.675	0.675	4.645	1.13	4.73a	4.73a	4.41a
–4	0.068	0.268	7.358	1.00	0.491	1.166	7.494	1.47	3.14a	3.49a	3.14a
–3	0.431	0.699	9.817	1.44	1.105	2.271	9.057	1.58	2.49b	2.29b	2.69a
–2	0.324	1.023	8.047	1.25	1.160	3.431	11.823	1.95c	3.96a	3.14a	4.73a
–1	0.203	1.226	10.814	1.86c	0.518	3.948	11.605	2.01b	2.29b	2.41b	3.14a
0	0.277	0.277	11.687	1.97b	0.632	0.632	12.272	2.16b	5.43a	5.43a	3.14a
1	0.580	0.580	8.634	1.37	0.831	0.831	9.865	1.89c	5.41a	5.41a	5.43a
2	–0.045	0.535	3.194	0.60	0.200	1.030	3.869	0.66	3.14a	3.14a	3.96a
3	–0.433	0.102	–2.894	–0.50	–0.132	0.898	0.030	0.01	3.50a	3.49a	3.50a
4	–0.216	–0.114	0.040	0.01	–0.004	0.894	3.566	0.61	4.41a	4.49a	4.14a
5	–0.017	–0.131	–6.530	–1.11	0.274	1.168	–0.129	–0.02	3.96a	3.41a	3.96a
Panel B: Stock payment											
–5	0.042	0.042	4.380	1.04	–0.239	–0.239	2.851	0.50	1.77c	1.77c	2.33b
–4	–0.079	–0.037	4.071	0.95	–0.056	–0.295	2.078	0.30	2.21b	2.59a	2.31b
–3	0.169	0.132	4.623	1.10	–0.493	–0.788	2.003	0.35	2.77a	2.44b	2.77a
–2	0.664	0.796	4.126	0.98	–1.250	–2.038	2.962	0.53	2.05b	2.29b	2.01b
–1	–0.018	0.777	4.325	1.02	–0.084	–2.122	2.926	0.52	1.78c	1.89c	2.01b
0	–0.032	–0.032	–0.528	–0.21	–0.016	–0.016	–0.704	–0.14	2.44b	2.44b	2.88a
1	0.101	0.101	–0.188	–0.05	–0.101	–0.101	–0.909	–0.26	2.23b	2.23b	2.21b
2	0.078	0.179	–3.076	–0.73	–0.289	–0.389	–1.920	–0.34	2.51b	2.01b	2.77a
3	–0.142	0.037	–4.914	–1.08	–0.099	–0.489	–2.024	–0.39	2.12b	2.01b	2.88a
4	–0.126	–0.089	–5.915	–1.27	0.061	–0.428	–2.358	–0.45	2.51b	2.77a	2.21b
5	–0.065	–0.153	–4.944	–1.22	–0.867	–1.295	–3.137	–0.56	2.21b	2.51b	2.21b
Panel C: Mixed (cash and stock) payment											
–5	0.204	0.204	1.713	0.61	0.308	0.308	5.607	0.64	4.49a	4.49a	5.01a
–4	0.061	0.265	0.838	0.21	0.151	0.459	5.534	0.63	5.18a	4.29a	4.46a
–3	0.259	0.524	4.366	1.09	0.362	0.821	7.959	1.17	5.18a	4.66a	5.71a
–2	0.129	0.653	3.830	0.92	0.385	1.206	9.648	1.44	5.37a	4.10a	4.83a
–1	0.080	0.733	5.487	1.45	0.203	1.409	10.916	1.73c	4.67a	4.29a	5.54a
0	0.225	0.225	6.849	1.57	0.240	0.240	13.235	1.93c	4.83a	4.83a	5.86a
1	0.262	0.262	5.256	1.47	0.498	0.498	12.642	1.76c	4.66a	4.66a	5.36a
2	–0.029	0.233	4.366	1.12	0.223	0.721	7.784	1.30	5.03a	4.83a	4.83a
3	–0.218	0.015	2.531	0.63	–0.053	0.668	4.021	0.46	5.18a	4.66a	5.18a
4	–0.122	–0.107	–1.866	–0.46	–0.018	0.650	–3.283	–0.44	6.35a	4.49a	6.65a
5	–0.049	–0.155	3.242	0.80	0.309	0.959	4.938	0.56	5.37a	4.66a	5.01a

Note: This table presents the average ARs estimates under the Carhart (1997) four-factor CAPM using the OLS and GJR-GARCH estimation methods. Panels A, B, and C present the results for cash payment, stock payment, and mix (cash and stock) payment, respectively. The adjusted BMP *t*-statistic due to Kolari and Pynnönen (2010) is used to test statistical significance. The Wilcoxon signed-ranks statistic tests for differences in the ARs over the estimation methods. a, b, and c denote the statistical significance at the 1%, 5%, and 10% levels, respectively.

portion of cash payment to close the deal, to signal the higher value of their stocks. Adverse selection on the part of acquirers can cause them to exchange stocks, as this allows targets to share the risk of over-payment using cash (Eckbo & Thorburn, 2000). This argument suggests that acquirers will make stock payment to shareholders of targets when there is high uncertainty about market value of targets. In contrast, acquirers will make cash payment when there is high uncertainty regarding their own market value. This means that payment methods will affect the magnitude of the CARs. So we analyze the ARs according to the method of payments.

Table 4 shows the estimated ARs for acquirers according to the payment methods. Under the OLS method, the CARs are positive and significant (p-value ≤ 0.10) when cash payments are made,

Table 5. Average AR measures around announcements for targets by payment method

Days	OLS estimation method				GJR-GARCH estimation method				Wilcoxon signed-ranks test		
	ARs	CARs	SCARs	t-stat	ARs	CARs	SCARs	t-stat	ARs	CARs	SCARs
Panel A: Cash payment											
–5	0.072	0.072	1.298	0.44	0.082	0.082	7.646	1.75	3.25a	3.25a	3.41a
–4	0.125	0.197	4.164	1.13	0.096	0.179	8.346	1.15	5.55a	4.46a	3.16a
–3	–0.050	0.146	3.268	1.14	0.031	0.210	9.202	1.08	4.16a	5.55a	4.25a
–2	0.203	0.349	4.494	1.44	0.450	0.660	8.843	2.06b	5.89a	6.02a	5.19a
–1	0.028	0.377	10.631	1.72c	0.112	0.772	11.215	2.63a	6.27a	6.02a	6.25a
0	2.188	2.188	16.537	2.71a	2.790	2.790	14.394	3.15a	5.16a	5.16a	5.19a
1	0.975	0.975	11.250	1.98b	0.963	0.963	9.549	2.33b	4.45a	4.45a	3.25a
2	0.032	1.007	5.168	1.20	0.061	1.023	9.384	2.20b	5.05a	6.51a	4.16a
3	0.120	1.127	4.390	1.04	0.125	1.148	5.231	1.20	4.89a	6.82a	4.25a
4	0.006	1.133	1.030	0.25	0.088	1.237	6.968	1.61	3.27a	6.41a	3.25a
5	–0.283	0.850	0.710	0.18	0.053	1.290	6.261	1.51	3.22a	6.95a	5.01a
Panel B: Stock payment											
–5	–0.090	–0.090	–0.749	–0.19	–0.045	–0.045	–0.573	–0.26	2.39b	2.39b	2.55b
–4	–0.143	–0.232	–1.176	–0.34	–0.048	–0.093	–2.080	–0.41	2.06b	2.77a	2.06b
–3	0.011	–0.221	–1.209	–0.36	–0.021	–0.113	–3.034	–0.67	2.77a	2.39b	1.97b
–2	–0.033	–0.254	–1.480	–0.45	–0.317	–0.431	–5.248	–0.99	1.97b	2.13b	3.97a
–1	0.004	–0.250	–1.856	–0.69	–0.021	–0.452	–5.398	–1.20	2.77a	2.77a	2.45b
0	–0.876	–0.876	–6.350	–1.51	1.014	1.014	–5.759	–1.43	3.39a	3.39a	2.77a
1	–0.448	–0.448	–3.187	–0.60	–0.324	–0.324	–3.821	–0.96	2.13b	2.13b	2.18b
2	–0.006	–0.454	–3.278	–0.55	–0.034	–0.358	–4.171	–1.05	2.55b	3.39a	5.57a
3	–0.018	–0.471	–3.463	–0.45	–0.032	–0.390	–4.266	–1.02	2.01b	3.39a	2.01b
4	–0.007	–0.478	–3.228	–0.39	0.078	–0.312	–3.622	–0.89	2.74a	2.77a	2.45b
5	0.137	–0.341	–1.948	–0.25	0.068	–0.244	–2.604	–0.76	2.01b	2.77a	2.74a
Panel C: Mixed (cash and stock) payment											
–5	0.044	0.044	1.082	1.09	0.035	0.035	4.496	1.43	2.56a	2.56a	2.86a
–4	0.059	0.103	2.282	1.12	0.063	0.098	4.805	1.53	3.11a	2.35b	2.35b
–3	–0.033	0.070	1.694	0.27	0.014	0.112	5.550	1.41	2.75a	2.35b	3.09a
–2	0.117	0.187	3.835	1.22	0.242	0.353	7.270	1.52	2.88a	2.71a	2.53b
–1	0.012	0.200	4.739	1.51	0.051	0.404	9.091	1.85c	2.17b	2.71a	2.83a
0	1.753	1.753	10.093	2.41b	1.758	1.758	14.030	2.48b	2.79a	2.79a	2.82a
1	0.532	0.532	9.670	1.93c	0.546	0.546	10.503	2.06b	2.90a	2.90a	3.54a
2	0.017	0.549	6.856	1.55	0.032	0.578	8.723	1.73c	2.80a	2.61a	3.38a
3	0.060	0.608	5.476	1.50	0.053	0.631	6.655	1.63	2.80a	2.71a	3.20a
4	0.003	0.612	4.571	1.45	0.051	0.681	5.411	1.48	3.27a	2.71a	2.87a
5	–0.148	0.464	3.616	1.15	0.047	0.729	4.937	1.57	2.86a	3.35a	2.56a

Note: This table presents the average ARs measures similar to Table 3 but for targets. The Wilcoxon signed-ranks statistic tests for differences in the ARs over the estimation methods. a, b, and c denote the statistical significance at the 1%, 5%, and 10% levels, respectively.

in line with previous studies (Heron & Lie, 2002; Fuller et al., 2002; Alexandridis et al., 2010). These CARs are only significant over the $t-1$ to t window. Under the GJR-GARCH method, the CARs are positive for both cash and mixed payments (p-value ≤ 0.10). Indeed, the significant CARs span up to 4-day window $t-1$ to t for cash payment. The significant CARs for mixed payment suggest the stock market attributes higher rewards to acquirers for sharing the risk of the M&As. The Wilcoxon signed-ranks test confirms that the CARs under the estimation methods have different medians (p-value ≤ 0.05).

Corresponding results for targets are shown in Table 5. The CARs are positive and significant across the payment methods, except for stock payment. As before, the persistence in the CARs is much stronger under the GJR-GARCH method. The Wilcoxon signed-ranks test also confirms that the CARs different under the estimation methods (p-value ≤ 0.05).

CONCLUSION

The event study methods are popular in the assessment of the economic benefits of mergers. There are issues around model specifications and the use of appropriate statistical tests. This study employs the Carhart (1997) four-factor model to estimate the ARs for U.S. firms around merger announcements. The Carhart (1997) four-factor model is estimated under both the OLS and GJR-GARCH estimation methods. The OLS method generates results that are generally in line with prior work. The GJR-GARCH method generates significant CARs for both acquirer and targets. Both estimation methods indicate that the use of stock payments does not generate positive CARs. In general, we show that the choice of the estimation methods impacts on the results. We suggest that the GJR-GARCH estimation method should be used especially when the daily CARs are estimated.

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