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Rumor Mill and Merger Waves: Analysis of Aggregate Market Activity

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Abstract

I examine timing of takeover rumors relative to merger waves. Peaks and troughs of rumor activity coincide with changes in the volume of takeovers. At aggregate market level, rumors should be viewed as coincident indicator of merger activity. Consequently, change in the number of rumors coupled with corresponding change in the merger volume can be interpreted as reversal in the direction of merger wave.

JEL classification numbers: G14, G34
Keywords: rumors, merger waves, timing, market efficiency

1 Introduction

Rumors have always been part of the business landscape, especially takeover rumors, which often precede merger announcements and therefore attract close investor attention. The Wall Street Journal's "Heard on the Street" column has become one of the primary sources of information for investment community, and specialized websites, for example, StockRumors.com, have emerged to keep retail investors abreast of the most recent developments in the rumor mill. A search on "merger rumors" in Google reveals more than 3 million hits[2].

The objective of this paper is to examine timing of merger rumors in the stock market and their relationship to aggregate takeover activity. More specifically, I test whether merger rumors can be viewed as leading, coincident or lagging indicator for merger and acquisition waves.

I find that rumors predict merger outcomes for individual firms, but do not precede future merger activity at market level or industry level. Rumor waves coincide with peaks of takeover

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activity, providing empirical support for the theoretical model developed by Van Bommel (2003), who shows that profit-maximizing informed investors intentionally spread rumors to trade at the expense of uninformed liquidity traders.
My findings have implications for several important constituents. First, they provide investors, including merger arbitrageurs who bet on the likelihood that the proposed transaction closes, with better understanding of public information that becomes available through rumor mill. Second, they can be of interest to regulators whose public mandate is investor protection.
The remainder of this paper is organized as follows. The next session reviews the relevant literature and formalizes major hypothesis. Section 3 describes our empirical framework and findings. Section 4 concludes.

2 Motivation for Study

My study connects two strands of academic literature – studies of merger waves and research on rumors. A large body of academic research documents that takeover activity occurs in distinct waves, and that merger activity tends to be greatest in periods of general economic expansion. Coase (1937) is one of earliest to argue that technological change will lead to mergers. Mitchell and Mulherin (1996) document that mergers occur in waves and that, within wave, mergers strongly cluster by the industry. Further, Andrade, Mitchell and Stafford (2001) provide evidence on industry clustering of merger activity in the 1990s following deregulation events, and Mulherin and Boone (2000) examine a sample of 1,305 firms in 59 industries during the 1990-1999 period and report industry clustering in both divestitures and acquisitions. Finally, Harford (2005) documents that technological or regulatory merger waves initiate industry merger waves, thus providing a neoclassical – as opposed to behavioral – explanation of merger activity.
A large number of mergers begin with rumors and trading by informed investors. Several studies document price run-up preceding merger announcement (Golbe & Schranz, 1994, Jarrell & Poulsen, 1989, King, 2009). Broader scholarly literature (Marshall, Visaltanachoti & Cooper, 2014, Mathur & Waheed, 1995, Pound & Zeckhauser, 1990, Zivney, Bertin & Torabzadeh, 1996) documents rumors' impact on stock prices. Further, Wysocki (1999) reports that postings on Yahoo! message boards are associated with real information flows by showing that overnight posting volume predicts trading volume, volatility, and, to some extent, abnormal returns. Kiymaz (2002) and Clarkson et al. (2006) provides evidence of price reaction to rumors in international setting.
Furhter, Bhagat et al (1987) and Jindra and Walkling (2004) find that merger arbitrage strategies generate substantial abnormal returns. Given that rumors have substantial price impact, it might be possible to design a profitable trading strategy bases on rumor events that precede merger announcements.
My paper also advances the broader research on market efficiency. Fama, Fisher, Jensen and Roll (1969) suggest that for information to have a market effect, it need not to be exact, but be better than no information. This argument suggests that as long as rumors increase information flow, they improve market efficiency. If rumors have information content, their impact on market efficiency will be stronger. Zivney, Berin and Torabzadeh (1996), provide evidence that the market reacts efficiently to initial rumors, but slightly overreacts in the post-rumor period.

Ex-ante, it is unclear whether rumors should precede, coincide with or follow merger waves. If rumors have informational content, they will predict merger activity at firm level and at market level. On the contrary, if rumors coincide with or follow merger activity, rumor waves will not have predictive power. The discussion above leads to the formulation of the following hypothesis stated in null form: rumors have information content and precede merger activity.
The alternative to this hypothesis is that rumor waves are coincident with merger activity or follow its peaks and troughs.

3 Data and Empirical Results

3.1 Sample description

By focusing exclusive on takeover rumors, we restrict the study to events well known to be the object of interest on part of investors. Also, merger rumor outcomes can be easily traced unlike other corporate rumors, including rumors of legal nature and rumors related to areas of operations and human resources. I consider all mergers announced between January 1, 1985, and December 31, 2010, as reported by Thomson Financial's Securities Data Company (SDC) and takeover rumors reported by Factiva database for companies listed on the major U.S. exchanges in 1985-2010. In order to identify exchange-listed companies, I downloaded names from the Center for Research in Security Prices (CRSP). CRSP reports data for a total of 28,181 firms in 1985-2010, excluding foreign firms, unit trusts and funds.
Factiva reports a large number of rumors carried by websites, including JagNotes.com and AppleInsider.com, which generate a large number of hits in 2000-2010, but not in earlier period. Therefore, we impose a filter to mitigate possible bias due to inclusion of rumors reported in digital press only. I examine rumors reported by major newswires, including the Dow Jones, Associated Press, Bloomberg and Reuters, and top 25 U.S. daily newspapers by average daily circulation reported by Audit Bureau of Circulations (ABC) for 2010.
Further, I exclude rumors that involve one company if time between rumor events is less than 30 days since one rumor can be re-cycled several times or can be reported by different news outlets on different dates. I identify 1,893 rumor events that involve exchange-listed U.S. firms in 1985-2010.

3.2 Timing of rumors and merger waves

Preliminary analysis of annual data suggests that merger waves precede rumor waves. Table 1 illustrates the large variation in the number of mergers and rumors each year from 1985 to 2010. Rumors peak out in 1989, 1998 and 2007, whereas mergers reach maximum levels in 1987, 1997 and 2005.
Table 2 provides a breakdown of rumors by industry. Academic literature provides substantial evidence of industry-clustering of mergers due to technological and regulatory shocks (Mitchell & Mulherin, 1996, Mulherin & Boone, 2000, Andrade, Mitchell & Stafford, 2001, Harford, 2005). Classification of industries by two-digit SIC code yields a small number of hits by industry. Fifty four out of 73 industries classified by two-digit SIC code have, on average, fewer than one rumor per year. I was unable to obtain reliable estimates using two-digit industry codes, so I test timing of rumors classifying industries by one-digit SIC code. Further, in industry-level tests I leave out SIC codes 100-900 due to a small number of agricultural and forestry firms in

Compustat. Compustat reports data for a total of 105 companies with SIC codes 100-900, and Factiva has zero hits on merger rumor search for these firms. The approach is common in the financial literature. Mitchell and Mulherin (1996) examine takeover and restructuring activity in 51 industries for which Value Line followed ten or more firms.

Table 1: Sample composition

Year	Total rumors	Total mergers
1985	71	587
1986	90	555
1987	66	683
1988	91	606
1989	118	447
1990	52	448
1991	46	488
1992	35	593
1993	45	791
1994	97	888
1995	149	972
1996	87	1,182
1997	134	1,237
1998	160	1,184
1999	143	1,058
2000	76	873
2001	35	666
2002	27	753
2003	42	619
2004	19	682
2005	41	788
2006	51	736
2007	81	527
2008	37	562
2009	32	558
2010	68	444
Total	1,893	18,927

In correlation analysis and regression models, I follow Lowry (2003), who scales data for initial public offerings (IPOs) and introduces autoregressive term of order one to account for nonstationarity in annual and quarterly time series. Rumors and mergers are scaled by the number of exchange-listed firms in Compustat database at the beginning of each period.

Table 2: Rumor breakdown by industry

Industry	Rumor	Compustat firms
0	0	105
1	45	2,846
2	339	3,279
3	495	5,427
4	246	2,412
5	178	2,322
6	308	7,669
7	237	3,649
8	34	957
9	5	408
45	1,887	29,074

Results reported in table 3 suggest that rumors and takeovers occur in waves, and that these waves share common characteristics. Both time series are highly persistent as evidenced by significant autocorrelation term in all model specifications, including annual, quarterly and monthly data. Strength of rumor waves and merger waves depends on market conditions as evidenced by significant coefficient on index return in current period and future market returns.

Table 3: Timing of rumor waves and merger waves

Panel A. Timing of rumor waves in market-wide regressions

	Year	Year	Year	Quarter	Quarter	Quarter	Month	Month	Month
Intercept	-0.09	2.81**	6.71**	0.25	0.65**	0.75***	0.01	0.54***	0.55***
	4.83	1.16	1.94	0.62	0.16	0.18	0.29	0.06	0.07
Index (t+1)	2.12			0.90*			0.56**		
	3.88			0.54			0.25		
Index (t + 3 months)		14.07*			1.78*			0.88*	
		6.95			1.06			0.5	
Index (t)			8.49**			2.05*			2.70*
			2.39			1.07			1.45
Volatility			-			-0.61			-12.02
			17.26			0.61			24.9
Market-to-	0.88			0.11			0.1678*		
	1.36			0.18			0.09		
AR(1)	0.56**	0.53**	0.48**	0.60**	0.60**	0.58***	0.44***	0.45***	0.45***
	0.17	0.16	0.12	0.08	0.08	0.08	0.05	0.05	0.05
N	26	26	26	104	104	104	312	312	312
Cluster	No	No	No	No	No	No	No	No	No
R-sq.	33.19%	42.01%	68.09%	39.81%	39.85%	40.81%	22.71%	21.91%	21.92%

Panel B. Timing of rumor waves in industry-level regressions

	Year	Year	Year	Quarter	Quarter	Quarter	Month	Month	Month
Intercept	0.34	1.25**	2.98**	0.28	0.82**	0.89***	0	0.79***	0.82***

	0.69	0.27	0.49	0.23	0.17	0.18	0.24	0.1	0.1
Index(t+1)	0.79			0.90**			0.67***		
	0.73			0.2			0.12		
Index (t + 3 months)		5.74**			1.74*			1.29***	
		1.03			0.87			0.38	
Index (t)			3.17**			2.49***			4.07***
			1.04			0.56			1.04
Volatility			-		-0.72**			-36.09*	
			3.69			0.27			17.47
Market-to-	0.29			0.15*			0.26**		
	0.23			0.07			0.1		
AR(1)	0.53**	0.52**	0.49**	0.44**	0.44**	0.43***	0.12*	0.12*	0.12*
	0.06	0.06	0.06	0.04	0.04	0.05	0.06	0.06	0.06
N	234	234	234	936	936	936	2,808	2,808	2,808
Cluster	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-sq.	28.18%	31.12%	39.16%	20.16%	20.14%	21.07%	2.06%	1.86%	1.99%

Panel C. Timing of merger waves in market-wide regressions

	Year	Year	Year	Quarter	Quarter	Quarter	Month	Month	Month
Intercept	-12.87	8.93*	5.73	0.28	2.62**	2.50***	0.73	2.34***	2.34***
	8.28	5.1	6.19	1.08	0.64	0.66	0.55	0.26	0.27
Index(t+1)	13.34*			1.91*			0.7		
	60.61			0.98			0.46		
Index (t + 3 months)		17.02			0.55			0.78	
		15.06			1.93			0.94	
Index (t)			16.68*			2.8			-0.12
			6.22			1.9			2.73
Volatility			26.65			0.97			14.54
			44.25			1.1			47.05
Market-to-	7.53**			0.90**			0.63***		
	2.38			0.35			0.19		
AR(1)	0.62**	0.72**	0.71**	0.62**	0.70**	0.70***	0.50***	0.56***	0.56***
	0.12	0.14	0.13	0.07	0.07	0.07	0.05	0.05	0.05
N	26	26	26	104	104	104	312	312	312
Cluster	No	No	No	No	No	No	No	No	No
R-sq.	67.37%	54.33%	63.68%	54.79%	51.48%	52.89%	34.09%	31.84%	31.73%

Panel D. Timing of merger waves in industry-level regressions

	Year	Year	Year	Quarter	Quarter	Quarter	Month	Month	Month
Intercept	-6.76	4.39**	0.36	0.31	3.39*	3.42	2.02**	5.03**	4.99**
	5.59	1.58	2.15	0.87	1.79	1.99	0.85	1.8	1.78
Index(t+1)	9.91**			2.1053			1.37		
	2.78			0.94			0.95		
Index (t + 3 months)		9.36			-1.36			1.12	
		8.28			3.34			1.04	
Index (t)			9.24**			4.59*			0.25
			3.85			2.21			4.59
Volatility			37.58			-1.27			72.77

			27.13			3.03			59.15
Market-to-	3.24			0.89**			0.99*		
	1.79			0.35			0.43		
AR(1)	0.80**	0.80**	0.80**	0.75**	0.76**	0.76***	0.46**	0.47**	0.47**
	0.03	0.03	0.03	0.13	0.12	0.13	0.14	0.14	0.14
N	234	234	234	936	936	936	2,808	2,808	2,808
Cluster	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-sq.	78.45%	77.90%	78.42%	59.96%	59.82%	59.93%	22.42%	22.16%	22.20%

However, mergers are explained by aggregate market valuations - high market-to-book ratio, whereas rumor waves are negatively correlated with market volatility and market sentiment measured by stock market returns in the next three-month period. It appears that takeovers are explained by fundamental factors, whereas rumors are related to sentiment-driven market characteristics, including short-term future market return and volatility.

Correlations analysis suggests that rumor peaks are coincident with increases in level of merger activity at aggregate market level (see table 4). Industry-level analysis supports this conclusion in annual data, but in quarterly and monthly time series rumors appear to follow mergers with a one-period lag. My preliminary conclusion is that rumors are either coincident or lagging indicators, but not leading indicators of merger activity. To confirm findings from correlation analysis, I test scaled rumor variable in the following regression model specification:

$$\frac{Merger_t}{N_{t\text{-}1}} = a_t + \sum_{j=t\text{-}30}^{j=t+30} \frac{Rumor_j}{N_{j\text{-}1}} + b_{s,t} \times AR(1) + e_t \qquad (1),$$

where N is the number of firms in Compustat at the end of the previous period.

Monthly data are examined over 30 periods preceding the merger month and over 30 periods after the merger month. In quarterly and annual data, regression coefficients are reported over a period of up to three years. In models with aggregate market-wide data, and in annual and quarterly regressions in industry-level data, betas are the highest for contemporary rumor variable (see table 5). Contemporary rumors variable is slightly smaller than its one-period lag in industry-level monthly regression models. I confirm that rumor waves lag or coincide with merger waves, and put to test the scaled rumor variable in two multivariate regression models that control for market characteristics:

Table 4: Correlations Analysis

	Annual	Annual, industry-level	Quarterly	Quarterly, industry-level	Monthly	Monthly, industry-level
Rumors (t-30)					0.1647***	0.0644***
Rumors (t-24)					0.1811***	0.0232
Rumors (t-18)					0.0818	0.0265
Rumors (t-12)			0.1574	0.0774**	0.1718***	0.0653***
Rumors (t-11)			0.1970**	0.0645**	0.2258***	0.0552***
Rumors (t-10)			0.2206**	0.1216***	0.1852***	0.0443**
Rumors (t-9)			0.2284**	0.0790**	0.1835***	0.0523***
Rumors (t-8)			0.2267**	0.0740**	0.2209***	0.0546***
Rumors (t-7)			0.2239**	0.0981***	0.2205***	0.0638***
Rumors (t-6)			0.1908*	0.0892***	0.1662***	0.0745***
Rumors (t-5)			0.2727***	0.1191***	0.1883***	0.0633***
Rumors (t-4)			0.3096***	0.1101***	0.2004***	0.0696***
Rumors (t-3)	0.2224	0.0820	0.3984***	0.1336***	0.2129***	0.0659***
Rumors (t-2)	0.3702*	0.1041	0.3941***	0.1569***	0.2492***	0.0569***
Rumors (t-1)	0.4511**	0.1488**	0.4299***	0.1633***	0.2939***	0.0892***
Rumors (t)	0.5972***	0.1794***	0.4868***	0.1524***	0.3377***	0.0759***
Rumors (t+1)	0.4021**	0.1242*	0.4050***	0.1346***	0.2532***	0.0689***
Rumors (t+2)	0.0076	0.0517	0.4374***	0.1445***	0.1793***	0.0621***
Rumors (t+3)	-0.3038	-0.0087	0.4242***	0.1296***	0.2086***	0.0621***
Rumors (t+4)			0.3299***	0.1061***	0.1998***	0.0385**
Rumors (t+5)			0.2791***	0.1115***	0.2202***	0.0508***
Rumors (t+6)			0.1919*	0.0901***	0.1995***	0.0562***
Rumors (t+7)			0.0996	0.0976***	0.2312***	0.0542***
Rumors (t+8)			0.0101	0.0545	0.1813***	0.0617***
Rumors (t+9)			-0.1003	0.0288	0.2104***	0.0511***
Rumors (t+10)			-0.1507	0.0211	0.1992***	0.0493**
Rumors (t+11)			-0.1479	0.0156	0.1533***	0.0543***
Rumors (t+12)			-0.2516**	0.0091	0.2073***	0.0357*
Rumors (t+18)					0.0580	0.0416**
Rumors (t+24)					-0.0686	0.0084
Rumors (t+30)					-0.1876***	-0.0153

$$\frac{Merger_t}{N_{t-1}} = \alpha_t + \beta_{s,t} \times \sum_{j=t-2}^{j=t+2} \frac{Rumor_j}{N_{j-1}} + \beta_{s,t} \times Index_{t-1} + \beta_{s,t} \times Sales_{t+1} + \beta_{s,t} \times AR(1) + e_t \quad (2)$$

$$\frac{Merger_t}{N_{t-1}} = \alpha_t + \beta_{s,t} \times \sum_{j=t-2}^{j=t+2} \frac{Rumor_j}{N_{j-1}} + \beta_{s,t} \times Index_{t+1} + \beta_{s,t} \times \left(\frac{Market}{Book}\right)_t + \beta_{s,t} \times AR(1) + e_t \quad (3),$$

where sales is future aggregate market sales and market-to-book is average ratio for all firms with Compustat and CRSP data. Detailed description of each variable is included in the Appendix. Mergers in current period are regressed on rumors in current period and two prior periods as well as two periods ahead.

Table 5: Betas in Univariate Regression Models with AR(1) Term

	Annual	Annual Industry-level	Quarterly	Quarterly Industry-level	Monthly	Monthly Industry-level
Rumors (t-30)					0.1386	0.2318*
Rumors (t-24)					0.2274**	0.0263
Rumors (t-18)					0.0935	0.0194
Rumors (t-12)			0.0590	0.2131	0.1016	0.1917
Rumors (t-11)			0.1173	-0.1357	0.2603**	0.1666
Rumors (t-10)			0.1487	0.3900*	0.1741*	0.1027
Rumors (t-9)			0.1437	0.1954	0.1274	0.1239
Rumors (t-8)			0.1783	0.0403	0.2120**	0.1120
Rumors (t-7)			0.2142	0.2574	0.2640***	0.1431
Rumors (t-6)			0.0255	0.0314	0.1292	0.2140*
Rumors (t-5)			0.1483	0.2822	0.1644*	0.1481
Rumors (t-4)			0.1068	0.0914	0.1731*	0.1843
Rumors (t-3)	0.0421	0.0111	0.2946*	0.1405	0.1551	0.1489
Rumors (t-2)	0.3636	0.0484	0.2418	0.2511	0.1815*	0.0630
Rumors (t-1)	0.2215	-0.0053	0.2113	0.2811	0.2415**	0.2292***
Rumors (t)	0.8810***	0.6000***	0.5092***	0.3841**	0.4283***	0.1900***
Rumors (t+1)	0.8594**	0.5286	0.2252	0.1567	0.3232***	0.1735*
Rumors (t+2)	0.5395	0.4081**	0.3237**	0.3014*	0.1351	0.1912*
Rumors (t+3)	0.0060	-0.0239	0.4086***	0.3406*	0.2050**	0.0605
Rumors (t+4)			0.2583*	0.1393	0.1592	0.1096
Rumors (t+5)			0.3147**	0.3110*	0.2288**	0.1344
Rumors (t+6)			0.2595*	0.0818	0.1485	0.1038
Rumors (t+7)			0.1335	0.2765*	0.2748***	0.1631***
Rumors (t+8)			0.1854	0.2242	0.1309	0.1153
Rumors (t+9)			-0.0297	0.0193	0.2030**	0.0952
Rumors (t+10)			-0.1288	0.0537	0.2365**	0.1686**
Rumors (t+11)			0.0687	0.0724	0.0841	0.0731
Rumors (t+12)			-0.1679	0.0454	0.2433**	0.0548
Rumors (t+18)					0.1056	0.1452
Rumors (t+24)					-0.0478	0.0264
Rumors (t+30)					-0.1560	-0.0217

Results for annual, quarterly and monthly data are reported respectively in table 6, table 7 and table 8. Coefficients on contemporaneous scaled rumors attain the largest value in all models except in monthly models with industry-level data, in which rumors lagged by one period are larger (see table 8). In all but one of the models, coefficient on scaled rumors is significant at 1 percent to 5 percent level. In one of the models with aggregate market data reported in table 5 scaled rumor coefficient is not significant at conventional levels, but this is due to interaction with other variables in the model.

Table 6: Regressions of Mergers on Rumors. Annual data

Panel A. Aggregate market tests

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Intercept	3.9	-16.3*	5.1	-14.2*	5.6	-13.4*	3.6	-14.5**	1.8	-18.2*
	4.8	8.0	5.0	8.2	4.8	6.9	5.0	6.8	6.4	9.1
Rumors (t-2)	0.5	0.6*								
	0.3	0.3								
Rumors (t-1)			0.2	0.5						
			0.4	0.4						
Rumors (t)					0.6	0.9***				
					0.4	0.3				
Rumors (t+1)							0.6	1.1***		
							0.3	0.3		
Rumors (t+2)									0.3	0.5
									0.4	0.3
Index (t-1)	1.7		0.5		-1.0		0.1		2.3	
	5.9		7.1		6.3		6.3		8.1	
Index(t+1)		14.2**		12.7*		10.7*		0.8		9.9
		6.2		6.5		5.6		6.4		7.0
Sales(t+1)	63.1***		59.6***		45.2*		44.5*		56.3**	
	19.6		20.6		22.2		21.9		21.1	
Market-to-Book		8.4***		8.3***		7.7***		7.3***		7.6***
		2.3		2.4		2.0		1.9		2.4
AR(1)	0.7***	0.5***	0.7***	0.5***	0.6***	0.5***	0.7***	0.5***	0.8***	0.7***
	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
N	26	26	26	26	26	26	25	25	24	24
Cluster	No	No	No	No	No	No	No	No	No	No
Adj. R-sq	63.6%	67.1%	66.1%	69.9%	68.9%	74.9%	69.6%	79.7%	66.9%	70.2%

Panel B. Industry-level tests

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Intercept	3.0	-7.2	3.3*	-6.9	2.3	-8.0	2.5	-7.2	2.1	-9.1
	1.8	6.1	1.7	5.7	1.4	5.5	1.9	6.0	1.5	5.6
Rumors (t-2)	0.1	0.1								
	0.3	0.3								
Rumors (t-1)			0.0	0.0						
			0.2	0.2						
Rumors (t)					0.6***	0.6***				
					0.2	0.1				
Rumors (t+1)							0.4	0.4		
							0.4	0.4		
Rumors (t+2)									0.4**	0.4**
									0.2	0.1
Index (t-1)	-2.7		-2.7		-4.0		-2.5		-1.0	
	3.3		3.1		3.2		2.8		2.8	
Index(t+1)		10.0***		9.9***		9.5***		7.7**		8.9***
		2.7		2.8		2.8		2.5		2.5
Sales(t+1)	22.0**		21.52**		17.5*		18.4*		21.2**	
	7.8		7.96		8.4		8.8		7.6	
Market-to-Book		3.3		3.3		3.2		3.1		3.6**

		1.8		1.8		1.8		1.8		1.8
AR(1)	0.8***	0.8***	0.8***	0.8***	0.8***	0.8***	0.8***	0.8***	0.8***	0.8***
	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
N	234	234	234	234	234	234	225	225	216	216
Cluster	9	9	9	9	9	9	9	9	9	9
Adj. R-sq	78.2%	78.5%	78.2%	78.5%	78.6%	78.9%	78.4%	78.6%	78.9%	79.2%

Contrary to other findings, in annual regression at industry level mergers significantly predict rumors lagged by two time periods (see panel B of table 6). However, this finding is not confirmed in models with quarterly and monthly data (see table 6). I conclude that merger rumors are coincident indicator of aggregate merger activity and are weak predictors of future merger waves.

Table 7: Regressions of Mergers on Rumors. Quarterly data

Panel A. Aggregate market data										
Cluster	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Intercept	2.7***	0.2	2.8***	0.2	2.6***	0.0	2.7***	0.1	2.8***	0.1
	0.6	1.1	0.6	1.1	0.6	1.0	0.7	1.1	0.7	1.1
Rumors (t-2)	0.2	0.3*								
	0.2	0.2								
Rumors (t-1)			0.2	0.3*						
			0.2	0.2						
Rumors (t)					0.5***	0.5***				
					0.2	0.1				
Rumors (t+1)							0.2	0.3*		
							0.2	0.2		
Rumors (t+2)									0.3*	0.42**
									0.2	0.2
Index (t-1)	0.6		0.7		0.3		0.8		0.8	
	1.0		1.0		0.9		1.0		1.0	
Index(t+1)		1.9*		1.9*		1.5		1.4		1.0
		1.0		1.0		0.9		1.0		1.0
Sales(t+1)	4.9*		4.9*		4.6		4.6		4.5	
	3.0		3.0		2.9		3.0		3.0	
Market-to-Book		0.9***		1.0***		1.0***		1.0***		1.0***
		0.4		0.4		0.3		0.4		0.4
AR(1)	0.6***	0.6***	0.6***	0.5***	0.6***	0.5***	0.6***	0.6***	0.6***	0.5***
	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
N	104	104	104	104	104	104	104	104	104	104
Cluster	No	No	No	No	No	No	No	No	No	No
Adj. R-sq	54.3%	56.1%	54.1%	56.1%	58.2%	60.5%	54.3%	56.1%	54.9%	57.0%

Panel B. Industry-level market data										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Intercept	2.9	0.2	2.8	0.1	2.7	0.1	3.0	0.2	2.8	0.2
	1.7	0.8	1.6	0.8	1.7	0.9	1.8	0.9	1.7	1
Rumors (t-2)	0.2	0.2								
	0.2	0.2								
Rumors (t-1)			0.3	0.3						
			0.3	0.3						
Rumors (t)					0.4**	0.4**				
					0.1	0.1				
Rumors (t+1)							0.1	0.1		
							0.2	0.2		
Rumors (t+2)									0.3	0.3
									0.2	0.2
Index (t-1)	1.4		1.4		1.4		1.7		1.6	
	1.1		0.9		1.0		1.1		1.0	
Index(t+1)		2.0*		2.0*		1.7		1.8		1.2
		1.0		1.0		1.0		1.2		1.0
Sales(t+1)	2.3		2.2		1.8		2.2		1.9	
	1.9		2.0		2.0		2.1		2.2	
Market-to-Book		0.9**		0.9**		0.8**		0.9**		0.8**
		0.4		0.4		0.3		0.4		0.3
AR(1)	0.8***	0.8***	0.8***	0.8***	0.8***	0.8***	0.8***	0.8***	0.8***	0.8***
	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
N	936	936	936	936	936	936	936	936	936	936
Cluster	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-sq	60.0%	60.1%	60.0%	60.1%	60.2%	60.3%	60.0%	60.1%	60.1%	60.1%

Other results in reported regression models are consistent with findings earlier reported in the literature. In model 3 in annual, quarterly and monthly data, aggregate market-to-book ratio is positively related to merger volume (see table 6, 7 and 8). Market-to-book ratio is a significant predictor of mergers in studies by Rhodes-Kropf, Robinson, and Viswanathan (2005), Ang and Cheng (2006), and Dong, Hirshleifer, Richardson, and Teoh (2006).

In model 2 in table 6, table 7 and table 8, past market returns do not predict merger waves, replicating result by Becketti (1986) who finds that number of mergers is not related to previous period return of the S&P500 index. Future aggregate sales are positive and significant.

Table 8: Regressions of Mergers on Rumors. Monthly data

Panel A. Aggregate market data

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Intercept	2.3***	0.7	2.3***	0.7	2.2***	0.7	2.2***	0.7	2.3***	0.7
	0.3	0.6	0.3	0.5	0.3	0.5	0.3	0.5	0.3	0.6
Rumors (t-2)	0.1	0.2*								
	0.1	0.1								
Rumors (t-1)			0.2**	0.3**						
			0.1	0.1						
Rumors (t)					0.4***	0.4***				
					0.1	0.1				
Rumors (t+1)							0.3***	0.3***		
							0.1	0.1		
Rumors (t+2)									0.1	0.1
									0.1	0.1
Index (t-1)	0.4		0.3		0.1		0.3		0.5	
	0.5		0.5		0.5		0.5		0.5	
Index(t+1)		0.6		0.6		0.4		0.4		0.5
		0.5		0.5		0.5		0.5		0.5
Sales(t+1)	2.5**		2.6**		2.5**		2.2**		2.5**	
	1.1		1.1		1.1		1.1		1.1	
Market-to-Book		0.6***		0.6***		0.6***		0.6***		0.6***
		0.2		0.2		0.2		0.2		0.2
AR(1)	0.5***	0.5***	0.5***	0.5***	0.5***	0.5***	0.5***	0.5***	0.5***	0.5***
	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
N	312	312	312	312	312	312	312	312	312	312
Cluster	No	No	No	No	No	No	No	No	No	No
Adj. R-sq	34.0%	34.0%	34.6%	35.4%	37.1%	37.9%	35.2%	36.3%	33.9%	34.4%

Panel B. Industry-level market data

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Intercept	4.7**	2.0**	4.6**	2.0**	4.6**	2.0**	4.6**	2.0**	4.6**	2.0**
	1.7	0.9	1.7	0.8	1.7	0.8	1.7	0.8	1.7	0.8
Rumors (t-2)	0.0	0.1								
	0.1	0.1								
Rumors (t-1)			0.2**	0.2***						
			0.1	0.1						
Rumors (t)					0.2**	0.2**				
					0.1	0.1				
Rumors (t+1)							0.2	0.2		
							0.1	0.1		
Rumors (t+2)									0.2*	0.2*
									0.1	0.1
Index (t-1)	1.1		0.9		0.9		1.0		1.0	
	1.2		1.2		1.2		1.2		1.2	
Index(t+1)		1.3		1.3		1.2		1.2		1.1
		1.0		0.9		1.0		0.9		0.9
Sales(t+1)	3.8		3.8		3.8		3.5		3.7	
	2.3		2.4		2.3		2.4		2.4	
Market-to-Book		1.0*		0.9*		0.9*		1.0*		1.0*

		0.4		0.4		0.4		0.4		0.4
AR(1)	0.5**	0.5**	0.5**	0.5**	0.5**	0.5**	0.5**	0.5**	0.5**	0.5**
	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
N	2808	2808	2808	2808	2808	2808	2799	2799	2790	2790
Cluster	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-sq	22%%	22%	22%	23%	23%	23%	23%	23%	23%	23%

3.3 Rumors in hot and cold markets

Numerous studies have attempted to find differences in quality of firms in hot and cold markets. The literature originates with seminal study by Ibbotson and Jaffe (1975), who document hot and cold periods in the market for initial public offerings. More recent IPO studies include Loughran and Ritter (1995) and Helwege and Liang (2004). In a related strand of literature on mergers, Yan (2011) and Duchin and Schmidt (2008) find that on-the-wave mergers tend to be value-destroying. Maksimovic, Phillips and Yang (2013) report that on-the-wave mergers result in larger increases in productivity.

If increase in the number of rumors is caused by activities of informed traders as predicted by Bommel (2003), then rumors generated at the peak of market activity should have lower information content. To confirm this proposition, I examine the proportion of correct rumors in hot and cold markets. I classify rumor months into cold and hot using median level of rumors as a cut-off, following methodology suggested by Ibbotson and Jaffe (1975). Proportion of correct rumors is reported for several windows up to five years following the rumor event in table 9.

Table 9: Percentage of True Rumors in Hot and Cold Rumor Markets

	Hot market	Cold market	Total	True hot market rumors, %	True cold market rumors, %	Z-statistic
Month 1	67	16	83	4%	4%	0.386
Month 2-3	54	14	68	3%	4%	0.279
Month 4-6	73	20	93	4%	6%	0.129
Month 7-12	125	14	139	7%	4%	0.054*
Total, year 1	319	64	383	17%	18%	0.620
Year 2	177	48	225	9%	13%	0.018***
Year 3	166	14	180	9%	4%	0.002***
Year 4	165	32	197	9%	9%	0.880
Year 5	155	26	181	8%	7%	0.564
Total	982	184	1166	52%	52%	0.908

Results are somewhat puzzling as percentage of correct rumors is not different in two states. I do not find additional support for Bommel's (2003) theoretical model in which small informed investors generate rumors to increase their information-based profits. It is possible that in cold markets reported merger rumors are subject to more scrutiny and therefore more credible news is reported. However, we cannot test this proposition due to data limitations.

3.4 Causality

Some of the rumors reported by the press have a short life span after publication in high-profile media outlets. Liu, Smith and Syed (1990) study the impact of recommendations in The Wall Street Journal's "Heard on the Street" column and suggest that publication in the HOTS column is the latest step in information diffusion process. Our finding that rumor waves are coincident with merger waves could have two explanations: either rumors are generated close to the date when merger announcements are made and, therefore, short windows of up to one month fail to capture information content of rumors with regards to future merger waves, or rumors about other companies surface after some takeover announcements are made. Given that the shortest period examined is one month, waves of correct rumors could coincide with merger announcements made shortly afterwards. To test this proposition, I test for endogeneity using two-stage least squares model (2SLS) with instrumental variables. I estimate rumor waves in the first-stage regression model autoregressive model with one lag using future three-month index returns and current period volatility. These variables are correlated with rumor waves but not merger waves (see results in table 3). Next, I test predicted scaled rumor variable in second-stage model that employs the same set of variables – market-to-book and next period market returns – as model 6 in tables 6-8. If rumor waves precede merger waves with a lag of less than one month, predicted rumor variable will be significant in second-stage of the 2SLS model. If predicted rumor variable is not significant in the second stage model, rumors are generated when merger announcements are made.

Results reported in table 10 do not lend themselves to simple interpretation. Predicted scaled rumor variable attains statistical significance in model regressions with monthly data, but not in quarterly or annual regressions. In quarterly regression with aggregate market data, the p-value on the scaled rumor coefficient is 0.108, close to conventional cut-off level for statistical significance. Results suggest that rumor waves have some information content. However, given low statistical significance of rumor variable in most models, there is substantial evidence that points in the opposite direction, namely that informed traders generate rumors to exploit profitable trading strategies.

Table 10: Timing of Merger Waves. Instrumental Variables Regression

	(1)	(2)	(3)	(4)	(5)	(6)
	Annual aggregate	Annual industry	Quarterly aggregate	Quarterly industry	Monthly aggregate	Monthly industry
Intercept	-13.23*	-6.62	0.09	-0.04	0.72	2.07**
	7.12	6.05	1.03	0.74	0.54	0.68
Rumors (t)	0.58	-0.07	0.43	0.59	0.58**	1.78*
	0.41	0.44	0.26	0.57	0.23	0.81
Index(t+1)	11.60*	9.95***	1.56	1.47	0.26	0.11
	5.81	2.74	0.95	1.07	0.48	1.22
Market-to-Book	7.66***	3.25	0.97***	0.78**	0.57***	0.54
	2.05	1.79	0.33	0.32	0.19	0.56
AR(1)	0.51***	0.80***	0.53***	0.74***	0.44***	0.44**
	0.13	0.03	0.09	0.13	0.06	0.14

N	26	234	104	936	312	2808
Cluster	No	Yes	No	Yes	No	Yes
Adj. R-sq	72.61%	78.33%	60.29%	60.15%	37.32%	8.96%

3.5 Robustness check

Substantial empirical evidence and a large number of academic studies (Pound & Zeckhauser, 1990, Wysocki, 1999, Zivney, Bertin & Torabzadeh, 1996) have shown that rumors have information content and that markets react efficiently to rumor events. My study suggests that rumor waves have little predictive power about future merger waves. To reconcile results reported in the literature with results reported in the earlier studies, I examine whether rumors have predictive power at individual firm level.

I report logistic models with a one-year horizon to predict merger outcome based on rumor event. Following Shumway (2001), we lag COMPUSTAT data to ensure that each firm's fiscal year ends at least six months before the beginning of the year of interest. I lag the market-driven variables in a similar fashion.

Results reported in table 11 separately for acquirer firms and target firms confirm that rumors are significant predictors of merger activity at firm-level. In addition to rumors, size, market-wide market-to-book ratio and future stock returns are significant in models with both targets and acquirors. Acquisitions are also related to firm leverage and firm-level market-to-book ratio.

Table 11: Logistic models

	(1)	(2)	(3)	(4)	(5)	(6)
	Annual aggregate	Annual industry	Quarterly aggregate	Quarterly industry	Monthly aggregate	Monthly industry
Intercept	-13.23*	-6.62	0.09	-0.04	0.72	2.07**
	7.12	6.05	1.03	0.74	0.54	0.68
Rumors (t)	0.58	-0.07	0.43	0.59	0.58**	1.78*
	0.41	0.44	0.26	0.57	0.23	0.81
Index(t+1)	11.60*	9.95***	1.56	1.47	0.26	0.11
	5.81	2.74	0.95	1.07	0.48	1.22
Market-to-Book	7.66***	3.25	0.97***	0.78**	0.57***	0.54
	2.05	1.79	0.33	0.32	0.19	0.56
AR(1)	0.51***	0.80***	0.53***	0.74***	0.44***	0.44**
	0.13	0.03	0.09	0.13	0.06	0.14
N	26	234	104	936	312	2808
Cluster	No	Yes	No	Yes	No	Yes
Adj. R-sq	72.61%	78.33%	60.29%	60.15%	37.32%	8.96%

I test the same model specifications in hazard model introduced by Shumway (2001). Results of various specifications are materially similar to results reported in table 11. However, in

Shumway model observations drop out from the sample upon occurrence of the event. Some firms make multiple acquisitions, so we choose to report logistic models.

4 Concluding Remarks

My paper studies timing of aggregate merger waves in 1985-2010. I make several contributions to the literature.

I find that rumors tend to cluster within a range at both aggregate market level and industry level. At aggregate market level, rumors should be viewed as coincident indicator of stock market activity. At industry level, rumor waves either coincide with merger activity or follow it with a lag of one. Consequently, change in the number of rumors coupled with corresponding change in the takeover volume can be interpreted as reversal in the direction of merger wave.

Increase in the number of takeover rumors coincides with increase in merger activity, suggesting that larger number of rumors may be generated by informed traders to profit at the expense of uninformed liquidity traders. However, this conclusion is mitigated by finding that proportion of correct rumors in is similar in both states - when rumor frequency is high and when it is low. Lack of difference in percentage of "true" rumors in hot and cold markets suggests there is no room for profitable trading strategies based on analysis of aggregate level of rumor events, and that profitable trading strategies can be exploited only at individual firm level. This resonates with Kiymaz (2002), who reports that investment decisions based on the published rumors do not benefit investors.

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Appendix A. Description of Variables

The appendix reports market variables and variables used to describe various characteristics of exchange-listed firms with data in Center for Research in Security Prices and Compustat

Index	Return on the S&P500 value-weighted index
Volatility	Mean of standard deviation of daily returns of firms
Market-to-Book, market-wide	Average of market-to-book ratios of individual firms
Market-to-Book, firm	Market-to-book ratio of exchange-listed firms with data in Center for Research in Security Prices and Compustat
Size	Natural logarithm of market capitalization, in $million
Sales	Change in aggregate sales
Leverage	Ratio of total debt-to-equity
Profitability	Ratio of earnings before interest and tax to shareholders equity