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Stock Returns Following Large Price Changes of Indian Stocks: A look at EMH

KEYWORDS: Market Efficiency, Uncertain Information Hypothesis, Overreaction, Emerging Markets

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ABSTRACT *We examine stock returns following large price increases and declines in the Nifty 50 to test EMH for the Indian stock market. The examination period lasts from January 2001 to December 2012. Our results show underreaction followed by strong momentum effects after positive price swings and overreaction of investors after large price declines. Our findings challenge the EMH but are consistent with the Uncertain Information Hypothesis. We report no significant difference between pre and post financial crisis patterns. We, however, find some indication for effects from inside information that decrease as the Indian market matures.*

Introduction
The efficient market hypothesis (EMH) is a formative part of modern finance and the foundation of neoclassical finance theory. It has been subject of many research studies of which some report inconsistencies. An influential string of research was initiated by De Bondt and Thaler (1985). They report predictable stock return patterns surrounding stock price swings.They attributed these findings to systematic investor overreactions to new information. De Bondt and Thaler's research spawned many studies that examine the phenomenon resulting in a variety of findings and explanations. Chan (1988) and Ball and Kothari (1989) attributethe detected reversals to errors in risk adjustment while Conrad and Kaul (1993) see patterns disappear when adjusting for transaction costs in illiquid markets.A number of studiesalso report opposing results and show investor underreactionand momentum in stock returns(Jegadeesh and Titman (1993), Ikenberry et al. (1995), Chan et al. (1996) and Benou and Richie (2003)). Brown et al (1988) propose an influential explanation assuming rational investor behavior in theirUncertain InformationHypothesis (UIH). They argue that rational risk adverse investors naturally overreact to negative information and underreact to good news as the impact of new events is not immediately transparent to investors.

The above insights stemfrom the mature US market. Recent studies have looked at EMH in markets outside the US and surfaced deviations in findings. The results suggest that efficiency may depend on the maturity and size of capital markets. To contribute to this discussion we look at the world's most active capital market in the world's third largest economy in PPP[1] terms: India. The National Stock Exchange of India (NSE) was ranked by the World Federation of Exchange (WFE) as the largest exchange by number of trades in equity shares before the NYSE, Euronext, and Nasdaq in 2013[2]. We aim at shedding light on the applicability of the EMH for this important market. In order to test efficiency we take a look at stock returns following large price swings of constituents of the S&P CNX Nifty index in a given month. The time period examined spans form January 2001 to December 2012 and, thus, includes data form before and after the recent financial crisis. We apply a generalized autoregressive conditional heteroskedasticity (GARCH) modelto risk adjust in order to gain abnormal returns in time windows spanning from 12 months before price swings to 36 months thereafter.

The remainder of the paper is organized as follows: The first section reviews the existing literature in the area of market efficiency. The third section describes the data collection and methodology. The fourth section presents the empirical results and the last section summarizes the findings.

1. Related research
Many studies analyze predictable patterns in stock returns and EMH. We follow the widely used approach to look at predictability of returns after price swings of stocks. Different strategies have been applied to examine this effect. In this literature review we will focus only on exemplary results representing different strings of research (a good overview of most existing studies has been presented by Amini et al. 2013).

A popular approach to test EMH was pioneered by De Bondt and Thaler (1985). Theyreview monthly return data of the New York Stock Exchange between January 1926 and December 1982 for two portfolios of winners and losers. The winner portfolio consists of firms in the top and the loser portfolio of the bottom decile of stock performance. The loser portfolio outperforms the market by 19.6% over a three year period. The winners underperform by 5.0%. De Bondt and Thaler (1985) deduct their Overreaction Hypothesis (OH) from these results suggesting predictable stock price patterns caused by an overemphasis of recent information when making investment decisions that leads to stock price reversals over time. In a second study De Bondt and Thaler (1987) test for risk-adjustment based on the Capital Asset Pricing Model (CAPM), seasonal effects, and the size effect. The results remain robust. Atkins and Dyl (1990) use a similar methodand examinestock returns after extreme price changes during a trading day based on the three top and bottom performers. Results show that companies with negative returns at the event day show positive abnormal returns whilewinners exhibit negative returns after the price change. However,

1 Source: IMF World Economic Outlook, October 2014
2 Source: WFE World Federation of Exchanges, January 2014

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Atkins and Dyl (1990) include transaction costs in their examination and find that on average investors would not have profited from these price reversals due to the size of the bid-ask spread and transaction costs.Zarowin (1990) tested for a size-effect. His findings show that losers tend to be smaller companies and outperform bigger ones, hence, controlling for size results in little return differences. Chopra et al. (1992) found that stocks of large and small firms are mainly held by different groups of investors. Stocks of bigger companies are predominantly held by institutional investors, which show no evidence of overreaction, while smaller firms show much larger overreaction effects. They suggest that individual investors tend to overreact in contrast to institutional investors.

Bremer and Sweeney (1991) introduced another effective approach to test EMH and stock price swings. They examined stock returns of firms listed in the Fortune 500 that show price declinesof more than 10% in a day and find strong price reversals in the days after the drop. The first day shows a return of 1.77% above average and rises cumulatively to 2.23% by the second day.Benou and Richie (2003) examine constituents of the S&P 100 Index that experienced stock price declines of more than 20% during a month testing price reversals in the long-run.They examine abnormal returns using both market-adjusted returns model and GARCH. They findup to 12% abnormal return over 12 monthssupporting the overreaction hypothesis. Benou (2003) also examines American Depository Receipts (ADRs) after an initial decline of 15% or more. Instead of a reversal pattern she found a momentum effect, i.e., underreaction. Also Jegadeesh and Titman (1993) find evidence for excess returns of a momentum strategy constituting the underreaction hypothesis (UH). Spyrou et al. (2007) report evidence for UH after extreme price movements for medium and small stocks. Results for large stocks are, however, are in line with EMH.

The above findings of price reversals and momentum following price swings challenge EMH as they suggest predictability of stock returns. Brown et al. (1988) introduce an alternative explanation for price reversal and momentum patterns which is in line with rational investment behavior and EMH.They set-forth that investors adjust firm value before they can fully assess the entire effects of unanticipated events. Brown et al (1988) argue that in the presence of imperfect information rational, risk-averse investors overreact to bad news and underreact to good news. As a result, once the uncertainty is resolved, stock prices will eventually adjust to the fair value of the event leaving abnormal returns at zero. They call their explanation uncertain information hypothesis (UIH).

A recent angle in this debate is the examination of international markets.The studies discussed above examine the US market. International results yield somewhat deviating results that trigger new insights.Dissanaike (1997),for example, examines the UK market. He finds evidence that supports the OH.Liu et al. (1999) argue against OH in the UK and provide strong evidence for momentum. Ising et al. (2006) cover the German stock-market. The results suggest over-optimism in the German market characterized by return reversal patterns after large price increasesand underreaction after price declines. Da Costa (1994) took a look at the Brazilian stock market. He found strong evidence for OH. The Australian market has been researched extensivelywith papers from Brailsford (1992), Allen and Prince (1995) and Gaunt (2000). They find no evidence in favor of market overreaction. Studies testing for momentum, however, show positive results (e.g., Hurn and Pavlov (2003), Demir et al. (2004)).Jefferis and Smith (2005) look at different African markets. The most mature South African stock market yielded results consistent with EMH. Egypt, Morocco, and Nigeria developed to be efficient towards the end of the examination period. The stock market of Kenya and Zimbabwe where not efficient. A recent study of the South African market showed evidence for over-and underreaction (Frisch et al. 2014). The authors also show an increase in beta post financial crisis. For theJapanese stock market overreaction has been observed (Iihara, Kato, and Tokunaga (2004),Chiao and Hueng (2005)).

Several studies examine the Indian stock market on market efficiency. Vaidyanathan and Gali (1994) found the Indian capital market to be weak-form efficient. Poshakwale (1996) examined the Bombay Stock Exchange (BSE) in the time frame between 1987 and 1994 using daily data. He also took a look at the day of the week effect. His results support the weekend effect in particular, as Friday returns are significantly higher than on other days. Rastogi et al. (2009) observed the Indian stock market regarding the momentum and overreaction effects controlling for size. Their results show strong evidence for short-run underreaction, i.e. stocks exhibit momentum, for all company sizes. Gupta and Basu (2007) applied the unit root tests, Phillips-Perron tests, and KPSS tests for both Indian stock market indexes, the BSE and the NSE. Their results points towards market inefficiency, as they reject the null hypothesis of unit root. The authors conclude that markets could have been influenced by volatility spillovers. Therefore they suggest using a generalized autoregressive conditional heteroskesdasticity (GARCH) model. Khan et al. (2011) investigated the weak-form market-efficiency on the BSE and NSE. Using a runs-test they find evidence for non-random-walk returns.Rezvanian et al. (2012) report investors' overreaction to large price changes. They observe the BSE and the NSE between 1995 and 2009.

We contribute to this research by taking a fresh look at the Indian market applying the GARCH model and including a pre- and post-financial crisis view.

2. Data and methodology

2.1 Applied data

This study examines the S&P CNX Nifty (Nifty 50), a market capitalization weighted index of 50 diversified stocks listed on the National Stock Exchange of India (NSE). The Nifty 50 is rebalanced semi-annually and accounts for 68.88% of Indian free float market capitalization as of June 28, 2013. The examination period spans from January 2001 to December 2012. Within the examination period 87 stocks have been listed in the Nifty. The average listing time for all constituents was 6 years and 11 months. 19 of the currently listed constituents are listed for the whole examination period. Historical data for constituents was obtained from Thomson Reuters Financial DataStream. Total returns were retrieved from the NSE Webpage Database. This study uses the Total Return Index (RI) for all calculations.

To analyze stock return behavior after large price swings we set the trigger value to 20% stock price decrease or increase in a month to determine large declines or increases, respectively. We follow the approach applied by Benou and Richie (2003). We identified 620 events that qualify of which 390 were increases and 230 declines. Table 1 shows the distribution over the sample period.

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Table 1: Distribution of large increases (Panel A) and declines (Panel B)

												Dec.	Total
Panel A													
2001	6	1		1	5			3		6	14	1	37
2002	4	3		3	2	5				1	6	2	26
2003	1			4	3	11	4	13	2	15	3	14	70
2004		2				1	3		3		5	4	18
2005		1			1	2	4	2	2		7	2	21
2006	4	2	6	3				3	2	1	3		24
2007	2			1	2		1		9	17		7	39
2008		4		5			11		1		2	12	35
2009			12	16	33		10	1	6		2	1	81
2010						1		1	2				4
2011			5		1					3			9
2012	17	1				1			6		1		26
Total	34	14	23	33	47	21	33	23	33	43	43	43	390
Panel B													
2001	1	2	16	1		6	2		9		1		38
2002					1	1	4	1	1	1			9
2003	1		3	2									6
2004	2		2	1	15								20
2005										3			3
2006					6	2						1	9
2007		5											5
2008	20	1	6		1	23	1	1	12	32	7		104
2009	8	4				1				6			19
2010											2		2
2011	3	2						4			4	1	14
2012					1								1
Total	35	14	27	4	24	33	7	6	22	42	14	2	230

2.2 Methodology

To test for abnormal returns (AR) we apply the market-adjusted-model proposed by Brown and Warner (1980) and the market-model (GARCH) developed by Brocket et al. (1999). Brocket et al. (1999)argue thatthe market-adjusted model mayfalsely detectabnormal returns and suggest a model that considers autoregressive conditional heteroskedastic effects (ARCH) in residuals of conventional market models.We apply their recommendedgeneralized autoregressive conditionally heteroskedastic GARCH (1,1) model to the residual term. The applied models are specified as follows:

The market-adjusted-model is defined as:

$$R_{jt} = R_{m,t} + \varepsilon_{j,t}, \qquad (1)$$

in which represents the return of a stock j at time t, the average return of the market portfolio and the error term for a specific stock at time t. To get monthly abnormal returns (ARs)the return of a specific stock j is adjusted by the average return on the market portfolio:

$$AR_{jt} = R_{j,t} - R_{m,t}. \qquad (2)$$

The GARCH (1,1) market model proposed by Brockett et al. (1999)and also applied byBenou and Richie (2003) specifies as:

$$R_{jt} = \alpha_j + \beta_j R_{m,t} + \varepsilon_{j,t}, \qquad (3)$$

for representing the Y-intercept. The factor stands for the slope of the linear regression of a stock j in relation to the market. The error term for stock j at time t is conditioned on the prior information set:

$$\varepsilon_{j,t} | \Omega_{t-1} \sim N(0, h_t),$$

for representing all information available at time t-1. The error term has a conditional distribution given by with a mean of 0 and variance of .The conditional variance of this model is calculated on a constant factor, squared past errors and the past conditional errors:

$$h_t = \phi_0 + \phi_1 \varepsilon_{t-1}^2 + \phi_2 h_{t-1}.$$

(5)

The parameters in (3) and (5) are estimated using the maximum likelihood method with daily returns of 1-year trading days prior to the event month. Abnormal returns defined as follows:

$$AR_{j,t} = R_{j,t} - (\hat{\alpha} + \hat{\beta} R_{m,t}).$$

(6)

The monthly average abnormal returns for a sample of N events is calculated as:

$$AAR_t = \frac{1}{N} \sum_{j=1}^{N} AR_{j,t},$$

(7)

where t represents the month for t=0 as the event month, so represents the average abnormal return for half a year following the event month. The next calculation is the cumulative average abnormal return for the event window [b, e]:

$$CAR = \sum_{t=b}^{e} AR_{j,t}, \qquad (8)$$

for b and e representing the months relative to the event month. For an event window e.g. of [1,6] we compute the CAR for the following half a year after the event starting from the first month following the event. Finally average CAR is calculated with the following formula:

$$ACAR = \frac{1}{N} \sum_{j=1}^{N} CAR$$

(9)

For the event window [b,e].

Parametric and non-parametric tests are used to test significanceof abnormal returns. The tests applied in this current study are the Jarque-Bera Test, standard t-Test and the Mikkelson-Partch Test.

3. Results

3.1 Descriptive Statistics

The sample contains 7,051 returns with a total number of 620 events, 8,6% of all returns.Figure 1 gives the return distribution of the overall sample. The sample has a mean (median) return of 1,89% (1,32%) with the lowest (highest) return of negative 70,81% (positive 82,97%). The standard deviation is 12,19%. The sample is normal distributed within the 99% confidence interval based on the Jarque-Bera test for normality.

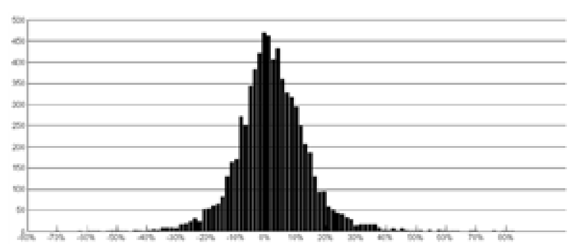

Figure 1: Return distribution of sample

The return distribution of events surpassing the trigger returns of positive and negative 20% is shown in Fig. 2. Price drops have an average return of -27,81% with a median return of 25,06 and a standard deviation of 8,52%. The group of price increases has an average (median) return of

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30,10% (26,24%) with a standard deviation of 11,16%.

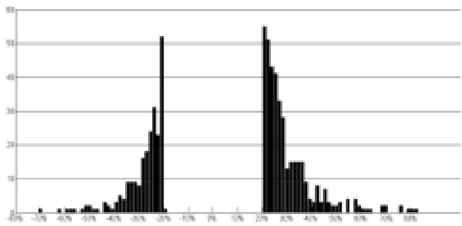

Figure 2: Return distribution of events (increases/declines)

3.2 Stock returns following price increases

First we look at abnormal returns surrounding large price increases. We will report only the market model results to discuss findings but will highlight any inconsistent results from the market-adjusted model. Generally the market model findings are consistently higher in value and more significant. Table 2 provides the ACAR for different time windows surrounding the month of the large increase. The time windows analyzed span from 12 months before the event month to 36 months thereafter.

Table 2: ACARs surrounding large stock price increases (market-model)

		AR		Test statistics			
		ACAR	Median AR	t-Test			
[-12;-1]	387	7,71%	10,09%	2,59	***	27,28	***
[-6;-1]	387	9,63%	10,92%	3,93	***	33,47	***
[1;6]	380	12,35%	7,00%	6,31	***	29,90	***
[1;12]	361	22,02%	24,81%	8,39	***	37,83	***
[1;24]	352	51,96%	49,66%	16,70	***	70,66	***
[1;36]	348	67,49%	65,94%	17,66	***	75,56	***
[3;6]	380	5,64%	3,43%	3,74	***	15,69	***
[3;12]	361	14,92%	15,33%	6,23	***	27,82	***
[3;24]	352	44,34%	43,96%	15,35	***	64,01	***
[3;36]	348	59,66%	60,08%	16,07	***	69,70	***
[6;12]	361	8,88%	10,09%	4,74	***	21,60	***
[12;24]	352	31,39%	26,40%	13,11	***	61,62	***
[12;36]	348	46,24%	45,74%	13,90	***	65,23	***
[24;36]	348	15,51%	11,93%	6,76	***	30,35	***

*, **, and *** denote significance at the 10%, 5%, and 1% level, respectively

The results show strongly positive abnormal returns in all analyzed time windows. Over a three year period the ACAR amounts to highly significant 67,49%. These resultsare not consistent with the EMH. They rather suggest strong momentum in the Nifty 50. The results from the market adjusted model underline the finding for the first two years after the event with a slight reversal effect in the third year. Previous research on the Indian stock market has frequently reported the anomaly (e.g., Rastogi et al. (2009)). Thus, investors in the Indian market seem particularly prone to this behavior.

Both reported pre-event time windows show significantly positive ACAR applying the market model. The monthly AARs (not reported, available on request) reveal that the abnormal returns occur within the first 4 months before the large price swing. This indicatesthat insight information may leakto some investors before eventannouncements. The market-adjusted model shows contradicting results for the pre-event period, therefore, the pre-event returns remain rather inconclusive.The analysis of events before and after the financial crisis (pre- and post-2008) shows results consistent with the overall sample (Tables 4 & 5). Deviations are reported for the third year in the post-2008 sample with shows a significant reversal of the momentum reported for the two preceding years. The pre-event data shows negative ACARs post-2008 indicating that positive news for previously challenged companies triggers large price swings.

Alternative to the observation of momentum the UIH could be an explanation for the observedeffects. The analysis of large declines will provide further insights.

3.3. Stock returns following price declines

The results for returns (Table 3) after large price declines provide strong evidence for overreaction to bad news by investors. The market-model as well as the market-adjusted-model show evidence in favor of the OH. The ACARs for both models grow in magnitude over time.

Table 3: ACARs surrounding large stock price declines (market-model)

		AR		Test statistics			
		ACAR	Median AR	t-Test			
[-12;-1]	225	9,34%	9,85%	2,23	**	18,65	***
[-6;-1]	225	0,68%	-2,00%	0,24		6,53	***
[1;6]	225	15,44%	14,26%	4,80	***	26,21	***
[1;12]	224	40,00%	32,82%	10,82	***	47,55	***
[1;24]	210	63,91%	69,58%	15,30	***	57,13	***
[1;36]	208	77,63%	83,45%	15,63	***	57,23	***
[3;6]	225	8,75%	9,84%	3,26	***	17,41	***
[3;12]	224	33,28%	27,28%	9,15	***	42,78	***
[3;24]	210	57,90%	55,87%	14,36	***	54,82	***
[3;36]	208	71,45%	75,37%	15,67	***	54,84	***
[6;12]	224	31,32%	23,70%	9,11	***	48,61	***
[12;24]	210	23,27%	24,23%	7,05	***	33,83	***
[12;36]	208	36,27%	35,95%	7,71	***	36,56	***
[24;36]	208	12,41%	5,81%	3,47	***	16,12	***

*, **, and *** denote significance at the 10%, 5%, and 1% level, respectively

The pre-event period is inconclusive. The one year pre-event window is positive and significant for the t-Test and the Mikkelson-Partch-Test (MP). The 6 month window is only significant for the MP-test. We are skeptical regarding MP results as they appear consistently very high and much higher than the t-Test. The MP-Test normalizes ARs by the weighted residual variance of the parameter estimation. If the residual variance is small in the models, the test could be biased. In contrast to the results by Himmelmann et al. (2012) the MP-Test in this paper indicates significance of almost all results and in most cases on a 1% level. As the MP-Test seems to be biased, we focus on the t-Test for discussion of results.

The analysis of pre- and post-2008 samples for large declines in Tables 6 & 7 is consistent with findings for the overall sample. We, however, report a comparable return reversal in the third year after the event in the post-2008 sample as for the price jump sample post-2008.

Taking into account the findings of underreaction to good news (momentum in stock returns following the event) and overreaction to bad news (return reversal after the event), the results are in line with the UIH explanation set-forth by Brown et al. (1988).

Conclusion

We examine the stock performance following large price increases and declines of at least 20% to test EMH for the Indian stock market. The examination period lasts from January 2001 to December 2012. We focus on constituents of the S&P CNX Nifty.

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Our results show strong momentum effects following positive price swings over the succeeding three years with most robust results for the first 12 months after the event month. Investors appear to underreact to good news. With regard to large price declines we provide evidence for anoverreaction by investors resulting in stock price drops that are reversed over time resulting in positive abnormal returns up to three years after the event.The results can be consistently observed in periods before and after the financial crises, however, with a decreasing trend. The results can also be interpretedin line with the uncertain information hypothesis (UIH) set-forth by Brown et al. (1988). Momentum after good news and overreaction after bad information are a pattern that is consistent with rational investor behavior under uncertain information.

Another finding indicates abnormal returns in the months leading up to large stock price swings which may be caused by inside information available to some investors. This effect, however, cannot be found for events after 2008 which suggests that the Indian market becomes more efficient with regard to information asymmetry..

Our findings are not consistent with EMH and propose that the Indian Market is not fully efficient yet. However, we see some indication for a reduction in inefficiency over time.

Appendix A: Robustness checks

We apply a number of robustness checks to our findings.The size effect, bid-ask spread and infrequent trading can be neglected for the S&P CNX Nifty sample.The fifty large firms of the Nifty are traded frequently and are large enough to avoid bias by bid-ask spread and market illiquidity (compare Benou and Richie (2003),Himmelmann et al. (2012); Ising et al. (2006)).We test for higher trigger values of 30% in a month. And split the sample for a comparison of pre- and post-2008 effects that consider potential effects from the financial crisis on investor behavior.

A1. Pre-/post crisis samples

We compare the total sample and samples of the pre- and post-2008 period to test for changes in market efficiency triggered by the financial crisis as has been reported eg. byHimmelmann et al. (2012). We find little differences in the market-model results for the different samples except a significant reversal during the third year of the post-2008 sample and generally smaller abnormal returns in the later sample. Tables 4& 5 show results for pre- and post-2008 subsamples, respectively.

Table 4: ACARs surrounding large stock price increases, pre 2008 (market-model)

		AR		Test statistics	
		ACAR	Median ACAR	t-Test	
[-12;-1]	234	27,10%	33,72%	7,60 ***	52,40 ***
[-6;-1]	234	19,23%	19,80%	7,02 ***	53,90 ***
[1;6]	234	8,35%	5,88%	3,64 ***	23,51 ***
[1;12]	234	14,85%	19,65%	4,94 ***	27,79 ***
[1;24]	234	54,64%	52,62%	14,97 ***	67,74 ***
[1;36]	234	80,32%	79,58%	17,77 ***	78,19 ***
[3;6]	234	2,90%	1,02%	1,66 *	10,47 ***
[3;12]	234	9,40%	12,45%	3,32 ***	18,85 ***
[3;24]	234	49,19%	45,22%	14,73 ***	62,94 ***
[3;36]	234	74,87%	69,08%	17,17 ***	74,17 ***
[6;12]	234	7,09%	6,02%	2,95 ***	16,69 ***
[12;24]	234	41,39%	40,47%	13,63 ***	66,63 ***
[12;36]	234	67,07%	66,60%	17,85 ***	75,50 ***
[24;36]	234	27,03%	27,25%	9,23 ***	39,98 ***

*, **, and *** denote significance at the 10%, 5%, and 1% level, respectively

Table 5: ACARs surrounding large stock price increases post 2008 (market-model)

Time window		AR		Test statistics	
		ACAR	Median ACAR		
[-12;-1]	153	-21,94%	-24,35%	-5,22 ***	-21,42 ***
[-6;-1]	153	-5,07%	-14,52%	-1,18	-13,42 ***
[1;6]	146	18,76%	10,48%	5,41 ***	18,48 ***
[1;12]	127	35,24%	33,59%	7,34 ***	26,06 ***
[1;24]	118	46,64%	48,47%	8,04 ***	26,64 ***
[1;36]	114	41,14%	40,51%	6,41 ***	20,00 ***
[3;6]	146	10,01%	7,31%	3,71 ***	12,07 ***
[3;12]	127	25,09%	24,16%	5,91 ***	21,33 ***
[3;24]	118	34,72%	38,10%	6,40 ***	21,92 ***
[3;36]	114	28,43%	30,52%	4,74 ***	15,52 ***
[6;12]	127	12,18%	12,17%	4,12 ***	13,76 ***
[12;24]	118	11,55%	12,19%	3,68 ***	12,60 ***
[12;36]	114	3,49%	3,75%	0,78	5,80 ***
[24;36]	114	-8,13%	-8,06%	-3,39 ***	-4,25 ***

*, **, and *** denote significance at the 10%, 5%, and 1% level, respectively

A remarkable finding are ACARs in the months before the event. In the pre-2008 sub-sample significant positive abnormal returns can be observed which hints towards information asymmetries caused by insight information. This effect cannot be observed post-2008. Suggesting that this effect has disappeared as the Indian stock market has grown more mature and better regulated. The post-2008 sample shows instead a negative abnormal return in the [-12,-1] sample. Which hint at a higher likelihood of former dogs to experience a large price jump when the market adjusts its previous assessment in post-financial crisis a market. This finding could be attributed to overreaction tendencies.

Table 6 and 7 provide the corresponding findings for large stock price declines pre- and post-2008. The results remain consistent across the two sub samples with exception of a reversal in the third year of the post-2008 sample analogous to the price increase finding.

Time window	N	AR		Test statistics	
		ACAR	Median ACAR	t-Test	Mikkelson/Partch
[-12;-1]	89	13,35%	13,45%	1,72 *	20,04 ***
[-6;-1]	89	5,16%	10,80%	1,17	13,47 ***
[1; 6]	89	17,16%	19,11%	4,28 ***	22,09 ***
[1; 12]	89	33,73%	27,57%	10,71 ***	28,20 ***
[1; 24]	89	47,99%	46,43%	8,46 ***	29,25 ***
[1; 36]	89	95,45%	89,04%	13,43 ***	44,35 ***
[3; 6]	89	6,38%	10,35%	1,93 *	12,46 ***
[3; 12]	89	22,95%	18,25%	7,45 ***	21,66 ***
[3; 24]	89	37,21%	38,60%	6,99 ***	24,33 ***
[3; 36]	89	84,67%	75,95%	12,71 ***	40,63 ***
[6; 12]	89	16,57%	14,35%	5,49 ***	17,39 ***
[12; 24]	89	16,96%	20,09%	3,58 ***	15,22 ***
[12; 36]	89	64,42%	57,42%	10,46 ***	35,53 ***
[24; 36]	89	46,18%	45,21%	8,08 ***	32,17 ***

*, **, and *** denote significance at the 10%, 5%, and 1% level, respectively

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Table7: ACARs surrounding large stock price declines, post 2008 (market-model)

Time window	N	AR		Test statistics			
		ACAR	Median ACAR	t-Test		Mikkelson/Partch	
[-12;-1]	136	6,72%	3,20%	1,42		7,78	***
[-6;-1]	136	-2,26%	-13,49%	-0,63		-2,50	***
[1; 6]	136	14,32%	10,14%	3,09	***	15,84	***
[1; 12]	135	44,13%	49,19%	7,67	***	38,36	***
[1; 24]	121	75,62%	80,93%	13,22	***	50,17	***
[1; 36]	119	64,30%	76,86%	9,70	***	37,31	***
[3; 6]	136	10,31%	8,44%	2,66	***	12,31	***
[3; 12]	135	40,09%	34,55%	7,14	***	37,52	***
[3; 24]	121	73,13%	72,51%	13,51	***	51,35	***
[3; 36]	119	61,56%	70,59%	10,11	***	37,36	***
[6; 12]	135	41,05%	36,46%	7,91	***	48,50	***
[12; 24]	121	27,92%	24,49%	6,18	***	31,51	***
[12; 36]	119	15,22%	18,12%	2,47	***	17,60	***
[24; 36]	119	-12,85%	-10,35%	-4,43	***	-6,51	***

*, **, and *** denote significance at the 10%, 5%, and 1% level, respectively

A2.Higher trigger value

In this analysis we apply a trigger value of 30% in a month opposed to 20%. As a result of the higher threshold 130 price increases and 59 price declines can be identified, which is around 30% of the events compared to a 20% trigger value.

The 30% increase samples does not show signifficant price increases in the months before the large swing challenging the earlier observation that indicate significant information leakage in the Indian market.The momentum observation is fully consistent with 20% findings. Table 8 shows the results.

Table 8: ACARs surrounding large stock price increases based on monthly returns for the 30% trigger value (market-model)

Time window		AR		Test statistics			
		ACAR	Median ACAR				
[-12;-1]	130	-9,03%	-8,97%	-1,64	*	3,94	***
[-6;-1]	130	6,69%	14,39%	1,43		17,95	***
[1; 6]	130	19,54%	13,55%	5,53	***	25,11	***
[1; 12]	119	26,66%	30,66%	5,42	***	23,30	***
[1; 24]	119	57,67%	62,68%	10,25	***	42,09	***
[1; 36]	118	67,89%	72,37%	9,09	***	42,56	***
[3; 6]	130	10,20%	8,14%	3,45	***	14,15	***
[3; 12]	119	16,82%	17,74%	3,71	***	15,02	***
[3; 24]	119	47,83%	48,63%	9,14	***	36,88	***
[3; 36]	118	57,77%	56,53%	8,01	***	37,96	***
[6; 12]	119	6,69%	11,25%	2,22	**	9,06	***
[12; 24]	119	30,35%	25,38%	7,52	***	33,23	***
[12; 36]	118	39,81%	39,49%	6,08	***	33,42	***
[24; 36]	118	8,43%	4,35%	2,09	**	11,89	***

*, **, and *** denote significance at the 10%, 5%, and 1% level, respectively

With regard to price declines in the more than 30% subsample the indication for an overreaction is confirmed. The sample, however, does not show the same ongoing abnormal returns in the second and third years after the event. The effect is limited to the 12 month post-event window. A significant negative abnormal return in the months before the price decline event indicates again the possibility of insider transactions. Table 9 reports the results.

Table 5: ACARs surrounding large stock price declines based on monthly returns for the 30% trigger value (market-model)

Time window		AR		Test statistics			
		ACAR	Median ACAR				
[-12;-1]	59	-6,48%	-16,69%	-0,78		0,52	
[-6;-1]	59	-10,17%	-19,22%	-1,79	*	-4,83	***
[1; 6]	59	24,45%	21,51%	4,00	***	18,69	***
[1; 12]	59	65,32%	60,57%	10,83	***	37,74	***
[1; 24]	57	76,20%	84,60%	9,03	***	31,99	***
[1; 36]	57	82,97%	75,59%	8,53	***	28,34	***
[3; 6]	59	12,87%	19,29%	2,42	**	12,63	***
[3; 12]	59	53,74%	49,90%	8,95	***	34,85	***
[3; 24]	57	64,55%	66,17%	8,23	***	29,17	***
[3; 36]	57	71,32%	68,58%	7,76	***	25,75	***
[6; 12]	59	50,57%	55,46%	8,55	***	39,50	***
[12; 24]	57	5,92%	4,88%	1,38		5,61	***
[12; 36]	57	12,69%	9,94%	1,42		6,71	***
[24; 36]	57	5,06%	-6,95%	0,67		2,63	***

*, **, and *** denote significance at the 10%, 5%, and 1% level, respectively

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