Stock Price Reaction in Stressful Circumstances: An International Comparison*

M. Ameziane Lasfer
City University of London

Arie Melnik
Haifa University

Dylan Thomas
City University of London

Abstract

The objective of this paper is to document stock price behaviour in the period following sharp price changes. In particular we focus on price behaviour using daily market indexes from 40 stock exchanges over the period 1989 to 1997. Our results are not consistent with the over-reaction hypothesis. We find positive (negative) abnormal price performance in the short-term windows (up to 10 days) following positive (negative) price shocks. Our analysis also highlights some important differences across markets classified as either developed or emerging. While the price shock occurrences are evenly distributed between our two groups of markets, we show that the post-shock abnormal performances are significantly larger for our sample of emerging markets. We find that the incidence of price shocks in both developed and emerging markets are not year- or month-dependent.

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1 Introduction

Sharp changes in stock prices were experienced by many stock markets in the past few years. Such changes should generate a renewed interest in the price behaviour of security markets under "extreme circumstances." This paper describes the price behaviour following large single day stock price changes.

Stock price movements are impacted by macroeconomic policy measures.[1] At the same time they require regulatory monitoring in order to maintain stability in the financial sector. The market crash of 1987 caused a variety of regulatory changes such as circuit breakers, daily price limits, improved settlement procedures and increased market making capacities.[2] These regulatory changes are geared to assist "markets under stress." Therefore the price behaviour under unusual circumstances is of particular interest.

Price behaviour under unusual circumstances has also been investigated as part of the "overreaction hypothesis." Earlier research on overreaction focused on US markets. US markets have been investigated by Brown, Harlow and Tinic (1988), Atkins and Dyl (1990), Park (1995) and many others.[3] It is interesting to examine if similar results hold for other exchanges and in particular in markets that are substantially less liquid than the US market.

The literature on overreaction is still inconclusive as to the underlying reasons for changes that follow large price changes. Further empirical research in different markets can shed more light on the issue. The importance of further investigation is re-emphasized following recent drastic price changes in various Asian stock markets.

The purpose of this paper is to contribute to the overreaction literature using daily returns and a large number of national stock market indexes from emerging and developed markets. Using various short-term event windows we examine the daily price reaction to large price changes. Large price changes are defined as realized daily returns which are two standard deviations away from the average return. We compare the price reaction patterns of developed markets to those of

[1] In this paper we do not explore the cause of a large single day change in stock prices. There is, of course, a large volume of literature that links stock price changes to economic and monetary factors. See, for example, Schwert (1990), Fama and French (1989), Fama (1990) and Jensen, Mercer and Johnson (1996).

[2] Many securities exchanges regulate asset price movements as a protective measure. Different exchanges impose different regulatory limits on drastic price changes. In the Tokyo Stock Exchange (TSE), for example, each stock has a daily price limit that is set at a fixed yen amount based on the previous day's closing price. Circuit breakers are used on the New York Stock Exchange (NYSE). These are the two main systems that are used to restrict drastic price movements. The NYSE "breakers" resemble the TSE price limits with two differences. First, circuit breakers are based on a market index rather than on individual securities. Second, circuit breakers trigger trading halts while price limits allow transactions to continue as long as they are within the limits. For a recent review of price limits see Kim and Rhee (1997).

[3] There are only a few studies that covered daily price distributions and overreaction in non-US markets. Good examples are the works of Alonzo and Gonzalo (1990) about the Spanish stock market and Da-Costa (1994) about the market in Brazil.

emerging markets.

The plan of the paper is as follows. In the next section we review the literature on overreaction. In Section 3 we provide some background information about the markets that we investigate. Section 4 describes the methodology and Section 5 contains the main empirical results. Section 6 describes some temporal effects and Section 7 extends them. Some concluding remarks appear in Section 8.

2 Review of the literature

One of the most widely documented stock market phenomena is the overreaction hypothesis. DeBondt and Thaler (1985, 1987) argued that investors tend to overreact to extreme price changes due to the human tendency to overweigh current information and underweigh prior data. If stock prices tend to "overshoot" their target levels after a large shock, the price reversal (following large price change "events") will reflect a movement back to equilibrium. Price reversals, following large unexpected changes, would thus be the expected result of bringing prices back to their fundamental values. This finding, which challenges the notion of market efficiency and is referred to in the literature as stock market overreaction, has generated a number of studies focusing on share price returns following large price changes.

Howe (1988), Brown and Harlow (1988), Atkins and Dyl (1990), and Bremer and Sweeney (1991) all document evidence which is broadly supportive of the investor overreaction hypothesis. In general these studies have tested for subsequent price reversal patterns in the short term (ranging from one day to a full year using daily/weekly data). Qualified support is also provided by Park (1995) on short term price movements (up to 20 days) following large price changes. Park finds that apparent price reversals on the first day following a price shock disappear when mid-prices are used instead of closing transaction prices which are affected by the bid-ask bounce. Moreover, while the short-run pattern of abnormal returns following large price changes does suggest overreaction, the magnitude of the returns is not sufficient to exploit economically. Overall, the sensitivity of some of these findings suggests some fragility in the definition and measurement of large price changes and in economic significance of the overreaction.

The pattern of price reversals cannot, however, be unequivocally attributed to investor overreaction. Other researchers, maintaining the underlying assumption of market efficiency, attribute the results of DeBondt and Thaler to factors other than overreaction. Chan (1988) reports small positive, "probably economically insignificant" risk-adjusted returns from an arbitrage portfolio of winners and losers after allowing for the differential risk characteristics of the two groups. More recently, Richards (1996 and 1997), using monthly index returns from 16 countries, shows that this apparent anomaly of winner-loser reversal is not a small market phenomenon and that loser countries are not more risky than winner countries. Jones (1987) relates the overreaction results to the January effects

while Zarowin (1989, 1990) extends the price reversals following large price changes to differences in firm size.[4]

Another strand of the academic literature has focused on momentum strategies. Momentum strategies also assume that present stock returns are influenced by past performance. However, present performance is positively correlated with earlier returns. Jegadeesh and Titman (1993) show that stocks with high returns over a given time period (of 3 to 12 months) continue to outperform the stocks of firms with lower past returns during the same period. Chan, Jegadeesh and Lakonishok (1996) also document the existence of medium-term continuation. In fact they argue that it can be partly explained by investors' underreaction to new information. More in line with the present research, a recent study by Rouwenhorst (1998) found that developed international equity markets exhibit a medium-term return continuation.

Rouwenhorst (1998) focuses on individual stocks using a sample of 2,190 stocks from 12 European countries. He finds that internationally diversified portfolios that acquire past medium-term "winners" and sell past medium-term "losers" outperform other possible portfolios. This outperformance cannot be attributed to conventional measures of risk. Our research is different in that, like Richards (1996), we study return patterns across markets at the country stock market index level.

3 Background information

We analyze a sample of 40 stock markets for the period of January 1, 1989 to December 31, 1997. The markets contain a wide spectrum of size, trading methods, government regulations and foreign participation. The markets can be split into two broad categories: advanced financial markets and emerging markets, particularly in Asia. The individual markets are categorized as either developed financial markets or emerging markets using the Financial Times and Morgan Stanley classification.

In terms of size, the sample includes the largest and most liquid stock markets. The top ten stock markets in terms of market value are all included. These are the US, Japan, UK, Germany, France, Canada, Switzerland, Hong Kong, Netherlands and Australia. At the other end we have some of the lesser liquid markets, such as Turkey, Greece, Pakistan, Jordan and Sri Lanka.

Our focus of attention is the stock index in each country (rather than individual shares). Table 1 provides summary statistics about the various indices. It confirms the known fact that there is a wide variation among financial markets.[5] The nine years that we cover (January 1, 1989 to December 31, 1997) include 2,331 trading days in most markets. We focus, of course, on daily returns. These are the

[4] Brown and Harlow (1986) show that even when the data for January are eliminated and the post-event betas are used, the overreaction still persists. DeBondt and Thaler (1987) show that the size effect is a complement and not a substitute for the overreaction results.

[5] The risks of international investments have been analysed extensively in the literature. See Erb, Harvey and Viskanta (1995, 1996), Ferson and Harvey (1991, 1994), and Harvey (1995).

returns of buying, in each country, a wide stockmarket index at the beginning of the day and selling it at the day's end. The mean daily return for each stock market is shown in Table 1. This measure is subject to significant variations as indicated by the relevant standard deviation.

The extreme values show that major price shocks can and do occur in each market. Negative and positive shocks in a single day should be compared with the mean daily return. Even on a non-comparative basis in many markets close to 10% price changes in a single day cannot be ruled out.[6]

[6] Of course, extreme price shocks are not an everyday occurrence. They are fairly rare. Even in the turbulent period that we investigate we find major advances (or declines) in only about 1.5% of the cases.

Table 1: Summary statistics of daily returns—Jan. 1989 - Dec. 31, 1997

	# Days	Mean Daily Return	Standard Deviation	Minimum Value	Maximum Value
Panel A: Developed Markets					
Australia	2331	0.027	0.809	-8.096	6.254
Austria	2331	0.046	1.282	-8.917	7.911
Belgium	2331	0.030	0.649	-5.146	6.881
Canada	2331	0.031	0.574	-6.174	2.007
Denmark	2331	0.040	0.649	-6.250	4.667
Finland	2331	0.034	1.120	-7.737	7.973
France	2331	0.033	1.103	-7.294	7.045
Germany	2331	0.056	1.135	-12.812	7.599
Hong Kong	2331	0.076	1.595	-21.745	18.824
Ireland	2331	0.050	0.856	-8.387	5.935
Italy	2331	0.025	1.252	-12.378	14.970
Japan	2331	-0.013	1.168	-6.965	11.050
Luxembourg	2331	0.044	0.727	-8.179	8.075
Netherlands	2331	0.060	0.790	-5.654	5.245
New Zealand	2331	0.027	1.031	-12.158	9.660
Norway	2331	0.063	1.078	-10.700	9.346
Singapore	2331	0.028	1.004	-10.250	7.432
Spain	2331	0.040	0.997	-8.251	6.569
Sweden	2331	0.053	1.073	-7.465	8.784
Switzerland	2331	0.067	0.979	-10.517	5.817
UK	2331	0.044	0.715	-4.062	5.863
USA	2331	0.054	0.705	-6.568	4.199
Panel B: Emerging Markets					
Bangladesh	2070	0.047	2.151	-29.280	38.596
Chile	2331	0.106	0.890	-4.306	5.305
Greece	2058	0.068	1.681	-7.893	14.740
India	2331	0.076	1.582	-9.762	18.106
Indonesia	2331	0.025	1.489	-13.126	38.232
Israel	2240	0.101	1.485	-11.300	8.199
Jordan	2331	0.035	0.732	-9.274	9.080
Malaysia	2331	0.036	1.330	-11.513	12.374
Mexico	2331	0.149	1.563	-13.337	11.690
Pakistan	2331	0.055	1.187	-8.740	7.382
Philippines	2331	0.049	1.577	-9.285	10.212
Portugal	2331	0.032	0.765	-7.227	6.828
South Africa	2331	0.053	0.964	-11.176	6.925
South Korea	2331	-0.023	1.465	-10.953	8.681
Sri Lanka	2331	0.065	0.967	-6.128	9.040
Taiwan	2331	0.044	2.147	-9.777	13.696
Thailand	2331	0.014	1.695	-10.963	10.603
Turkey	2331	0.326	2.755	-10.976	13.855

Sources: Authors' calculations.

4 Methodology and data

We collected daily data for 40 developed and emerging market indices for the period January 1, 1989 to December 31, 1997. For each market we use a broad index that provides data, for most countries, on 2,331 trading days. The individual markets are categorised as either advanced financial markets or emerging markets using the Financial Times and Morgan Stanley classification.

In the existing literature there is no uniform definition of 'large' price changes. Various researchers use different definitions. For example, Howe (1986) defines 'large' price changes as those weekly price changes exceeding 50 percent. Brown, Harlow and Tinic (1988) and Park (1995) define 'large' changes with reference to the market model residuals. Atkins and Dyl (1990) choose those stocks with the largest one-day price change in a 300-day window. Bremer and Sweeney (1991) base their results on the stocks that recorded a daily price decrease of at least 10 percent.

We define a positive price shock as one where the return on a particular day exceeds, by two standard deviations, the average market daily return. The average return is computed over the previous 50-day trading period ending 10 days before the day on which the positive price shock is recorded. The standard deviation is also computed over the same 50-day period. Similarly, we define negative shocks as occurring when the daily price return lies two standard deviations below the average of the previous 50 trading days. This method allows us to consider, for each market and for each day in our sample period, changes in risk characteristics. Table 2 provides the classification of these markets, the indexes used, the number of positive and negative shock, and the average size of the price shocks.

In a number of instances, successive price shocks, as defined above, followed within less than 10 days of each other. These cases obviously cause confounding results when tracking the post-shock abnormal returns for a particular market. To avoid any confounding effects, we eliminate for each individual market, those "double" price shocks occurring with 10 trading days of the previous shock. This group of events constitutes our "Sample" data.[7]

The first two columns of Table 2 report the country and the name of the index. We have included 22 countries in the developed markets sample and 18 countries in the emerging countries sample. When we use non-overlapping events we find 32 positive and 39 negative shocks per developed country on average. The corresponding figures for the emerging markets are 36 and 34, respectively. Thus, there are more positive shocks per market in the emerging markets and more negative shocks per market in the developed markets.

[7] The cases of double price shocks should be analyzed separately by treating the second and third shocks as "after shocks." In this study we treat each shock as an individual event and so do not analyze cases of multiple shocks that occur in succession.

Table 2: Description of average shocks

Country	Index	Positive Shocks		Negative Shocks	
		N	Return	N	Return
Panel A. Sample and Characteristics of Shocks in Developed Markets					
Australia	AUSTALL	33	1.87	39	-1.93
Austria	ATXINDX	32	3.37	47	-2.68
Belgium	BRUSINDX	28	1.44	52	-1.56
Canada	TTOCOMP	30	1.16	43	-1.25
Denmark	CHAGENI	30	1.47	44	-1.69
Finland	HEXINDX	33	2.78	41	-2.27
France	FRCAC40	31	2.38	40	-2.41
Germany	DAX	25	2.35	41	-2.78
Hong Kong	HNGKNGI	38	2.93	40	-3.74
Ireland	GJCIREQ	39	2.11	31	-2.51
Italy	ITMBGEN	30	3.10	29	-2.99
Japan	JAPA500	29	3.08	38	-1.72
Luxembourg	LXLUX13	39	1.88	37	-1.72
Netherlands	CBSKGEN	30	1.83	40	-1.86
New Zealand	TOTMKNZ	37	2.42	34	-2.54
Norway	OSEINDX	35	2.37	31	-2.69
Singapore	SNGPORI	40	2.12	37	-2.21
Spain	MADRIDI	35	2.09	37	-2.54
Sweden	AFFWALL	30	2.75	38	-2.18
Switzerland	SWISSMI	29	2.21	38	-2.52
UK	FTALLSH	22	1.82	39	-1.66
US	NYSEALL	31	1.52	42	-1.66
Panel B. Sample and Characteristics of Shocks in Emerging Markets					
Bangladesh	BDTALSH	38	3.88	28	-4.97
Chile	IGPAGEN	37	1.89	32	-2.03
Greece	GRAGENL	34	4.13	22	-3.31
India	IBOMBSE	34	4.02	38	-3.25
Indonesia	JAKCOMP	35	2.49	35	-2.14
Israel	ISTGENS	23	4.11	40	-3.61
Jordan	AMMANFM	52	1.83	25	-1.80
Malaysia	KLPCOMP	40	3.32	30	-2.48
Mexico	MEXIPCI	34	3.78	29	-3.61
Pakistan	PKSE100	40	2.81	33	-2.86
Philippines	MANCOMP	35	3.86	39	-3.82
Portugal	LISBBTA	36	1.77	27	-1.83
S. Africa	JSEOVER	33	2.32	40	-2.02
S. Korea	KORCOMP	42	3.11	33	-3.43
Sri Lanka	SRALLSH	36	1.99	36	-2.04
Taiwan	TAIWGHT	31	4.43	41	-4.24
Thailand	BNGKBKC	40	3.66	33	-3.65
Turkey	TOTMKTK	34	6.38	33	-5.92

The table reports the sample of markets included in the analysis. Each country contains 2,331 observations except for Bangladesh with 2,070, Israel with 2,240 and Greece with 2,058.

Sources: Authors' calculations.

The magnitude of the shocks is, however, substantially larger in the emerging markets compared to developed markets. The average positive shocks range between 1.16 percent (Canada) to 3.37 percent (Austria) in the developed markets. In contrast, in the emerging markets, the lowest positive return is 1.83 percent (Jordan) and the maximum is 6.38 percent (Turkey). Similarly, the negative shocks range between -1.25 percent (Canada) to -3.74 percent (Hong Kong) for the developed markets but between -1.80 (Jordan) to -5.92 (Turkey) percent for the emerging markets. When we use all data over the whole sample period, we find that Canada (Jordan) has the lowest standard deviation while Hong Kong (Turkey) has the highest standard deviation amongst the developed (emerging) markets.

After computing the price shocks, we calculate the post-shocks abnormal returns, AR_{it}, as follows:

$$AR_{it} = R_{it} - E(R_{it})$$

where R_{it} is the daily return on the index i and $E(R_{it})$ is the average return of a 50-day window ending 9 days prior to the price shock. The 9-day gap allows us to abstract from any possible unusual price lead-up immediately prior to the price shock.[8] These abnormal returns are accumulated over 1, 3, 5, and 10 days following the price shock by adding them up over these periods.[9]

5 Main empirical results

Table 3 provides a summary of the post-price shock cumulative abnormal returns. Panel A shows the post-positive shocks for the non-overlapping cases. There are 706 such events. The post-shock cumulative abnormal returns are generally all positive and significant. In the case of developed markets the CARs increase from 0.29 percent in the day that follows the positive shock to 0.92 percent in the following 10 days.

The cumulative abnormal returns experienced by investors in developed markets following positive price shocks are similar in pattern to those obtained in emerging markets. As noted earlier in emerging markets, the positive shocks are larger than those in the developed markets. The post-shock CARs are also larger in emerging markets. They increase from 0.65 percent on the first day after the shock to 1.95 percent after 10 days. Figure 1 displays the CAR values following positive price shocks for both developed and emerging markets using our sample.

[8] We tried other gaps without much impact on the results.

[9] This general approach is the one used by Brown and Warner (1980, 1985) and by most researchers in the field.

Table 3: Post-price shock cumulative abnormal returns

The table reports the cumulative abnormal returns following positive and negative shocks in both developed and emerging markets.

	N	Mean Shock	CAR 1	CAR 3	CAR 5	CAR 10
Panel A: Post-Positive Shocks						
Developed	706	2.24	0.290***	0.515***	0.697***	0.916***
		(44.68)	(6.29)	(7.41)	(7.31)	(6.46)
Emerging	654	3.23	0.651***	1.214***	1.481***	1.951***
		(34.90)	(9.14)	(9.42)	(8.52)	(7.62)
Panel B: Post-Negative Shocks						
Developed	847	-2.24	-0.12***	-0.192***	-0.227***	-0.526***
		(-41.46)	(-2.26)	(-2.26)	(-2.29)	(-4.03)
Emerging	591	-3.20	-0.31***	-0.213	-0.398***	-0.872***
		(-34.65)	(-3.52)	(-1.31)	(-1.99)	(-3.19)
Panel C: t-statistics in Differences in Means between Developed and Emerging Markets						
Positive Shocks		9.38	4.26***	4.77***	3.95***	3.53***
Negative Shocks		8.98	1.90	0.11	0.76	1.14
Panel D: t-statistics in Differences in Means between CARs						
CARs	Positive			Negative		
	CAR1	CAR3	CAR5	CAR1	CAR3	CAR5
Developed Markets						
CAR3	2.71***			-0.76		
CAR5	3.85***	1.54		-0.99	-0.27	
CAR10	4.20***	2.54***	1.29	-2.96***	-2.14**	-1.82*
Emerging Markets						
CAR3	3.83***			-0.52		
CAR5	4.42***	1.23		-0.40	-0.72	
CAR10	4.89***	2.57***	1.52	-1.96***	-2.07***	-1.40

***, **, * significant at 0.01, 0.05, and 0.1 levels, respectively.

Panel B in Table 3 contains CAR values following negative shocks. There are 847 such cases in the developed markets. The cumulative abnormal returns are significant. They decrease from -0.12 percent in the day immediately following the price shock to -0.53 percent in the subsequent 10 days. In emerging markets there are 591 events of drastic price shocks. With the exception of the 3 day CARs all the post-negative shock abnormal returns are negative and statistically significant. Figure 2 depicts the post-negative shock CARs in both developed and emerging markets.

The decline in returns seems to be larger than the comparable decline observed in the developed markets. Panel C (in Table 3), however, reports that the differences in cumulative abnormal returns following a negative shock are not

significant. In contrast, the differences in the average size of CARs following positive shocks are all significant. It appears that price increases in the emerging markets are significantly larger and that investors in these markets earn substantially higher returns after their markets experience a large positive price shock.

Panel D, Table 3 reports the t-statistics of the differences in means between the different CARs. In both the developed and the emerging markets, the CARs following positive shocks exhibit a similar pattern. The increases in abnormal returns following the first day cumulative abnormal returns are all positive and statistically significant. This suggests that prices continue to adjust in the same direction. Similarly, the increase in the abnormal returns from day 3 to day 10 is statistically significant. However, the increase in CARs from the 3rd to the 5th day is not significant. In contrast, the differences in cumulative abnormal returns following negative shocks are not always statistically significant. The pattern of significance suggests that the changes in abnormal return continue to be negative. However, the differences in the CARs are only significant for day 10 relative to the other CARs. In particular, we observe that most of the decline occurs between day 5 and day 10.

Figure 1: Post-positive shock cumulative abnormal returns (sample)

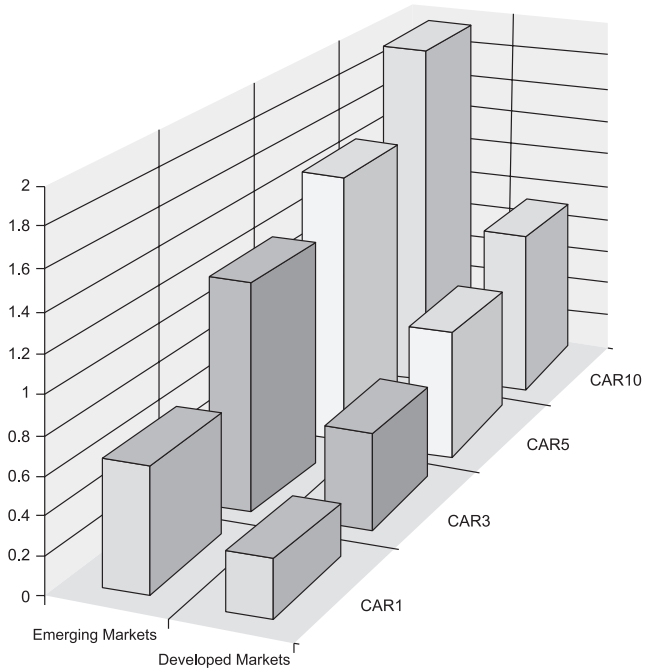
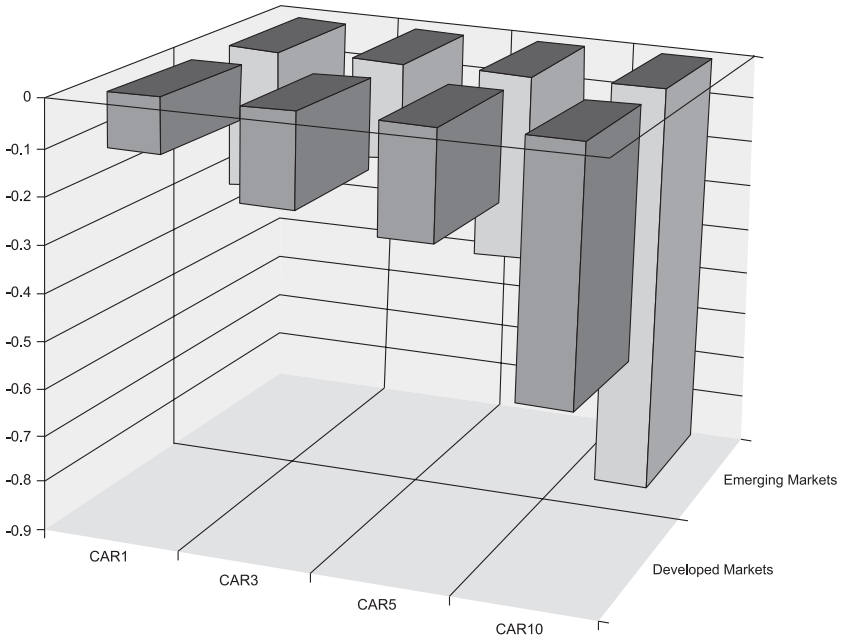


Figure 2: Post-negative shock cumulative abnormal returns (sample)



6 Temporal effects

To investigate the possibility that our results are driven by price jumps in a particular year of our sample period, we split our data into each individual calendar year in our sample period. The full results are reported in Table 4. The first row of each panel reports the number of annual cases. We note that the positive and the negative price shocks are not confined to a particular year in the sample period. The lowest number of shocks appears to have happened in 1989 and the largest number is in 1993. However, the differences across the years are not substantially large to affect our results. The results are qualitatively similar to those obtained using the full sample.

Table 4: Annual distribution of positive and negative shocks and post-shock cumulative abnormal returns

	1989	1990	1991	1992	1993	1994	1995	1996	1997
Panel A: Positive Shocks - Developed Markets Sample									
Number (%)	51 (7.2)	76 (10.8)	86 (12.2)	81 (11.5)	103 (14.6)	66 (9.4)	90 (12.8)	80 (11.3)	73 (10.3)
Average	1.716	2.582	2.668	2.663	2.177	2.245	1.866	1.956	2.139
CAR 1	0.485	0.782	0.161	0.281	0.397	0.291	0.114	0.003	0.179
CAR 3	0.752	0.994	0.442	0.553	0.542	0.761	0.499	0.138	0.068
CAR 5	1.123	1.244	0.742	1.076	0.633	0.741	0.549	0.151	0.182
CAR 10	1.085	1.351	1.908	1.229	0.561	0.759	0.854	0.275	0.254
Panel B: Positive Shocks - Emerging Markets Sample									
Number (%)	45 (6.9)	68 (10.4)	80 (12.2)	77 (11.8)	94 (14.4)	63 (9.6)	73 (11.2)	86 (13.2)	68 (10.4)
Average	2.935	3.873	3.551	2.883	2.932	3.138	2.844	3.323	3.596
CAR 1	0.912	1.174	0.525	0.450	0.388	0.502	0.470	0.591	1.098
CAR 3	1.126	2.511	0.831	0.804	1.128	1.079	1.329	1.023	1.254
CAR 5	0.984	3.188	1.122	1.112	1.288	1.230	1.598	1.368	1.458
CAR 10	1.806	2.789	2.146	2.191	1.888	1.357	2.158	1.173	2.106
Panel C: Negative Shocks - Developed Markets Sample									
Number (%)	69 (8.2)	111 (13.1)	86 (10.2)	84 (9.9)	95 (11.2)	102 (12.0)	85 (10.0)	100 (11.8)	115 (13.6)
Average	-3.024	-2.357	-2.782	-2.122	-1.905	-2.186	-1.789	-1.740	-2.406
CAR 1	-0.242	-0.558	0.251	-0.232	-0.260	0.062	-0.120	0.063	-0.287
CAR 3	0.233	-1.069	0.977	-0.125	-0.160	0.179	-0.007	-0.100	-1.092
CAR 5	0.376	-0.660	0.764	-0.189	-0.431	-0.127	0.072	-0.436	-0.899
CAR 10	-1.337	-1.782	0.738	-0.250	-0.565	-0.282	0.344	-0.489	-0.835
Panel D: Negative Shocks - Emerging Markets Sample									
Number (%)	48 (8.1)	74 (12.5)	54 (9.1)	60 (10.2)	58 (9.8)	72 (12.2)	72 (12.2)	64 (10.8)	89 (15.1)
Average	-3.048	-3.266	-3.452	-2.780	-2.622	-3.334	-2.864	-3.147	-3.912
CAR 1	-0.233	-1.064	-0.129	-0.183	-0.090	-0.514	-0.451	-0.072	0.049
CAR 3	-0.389	-1.506	-0.249	-0.240	0.052	-0.958	0.386	0.450	0.457
CAR 5	-0.287	-1.606	-0.737	-0.498	-0.065	-1.218	0.339	0.302	0.168
CAR 10	-0.539	-1.917	-1.684	-1.578	-0.128	-2.602	0.324	-0.125	0.193

In the analysis of the post-shock cumulative abnormal returns, we find significant annual differences across the two types of market throughout the sample period. The cumulative abnormal returns reached their peak in 1990 and 1991. However, throughout the sample period, the post-shock abnormal returns have decreased substantially. In 1996 and 1997 they decreased to their lowest level. In contrast, in the emerging markets, the post-positive shock cumulative abnormal returns are relatively constant throughout the sample period. Again, the levels in 1990 are, however, larger than the other years.

In the case of stock market behavior that follows negative shocks, we observe a slightly different pattern. In the case of developed markets in 1991 (Panel C in Table 4) we observe a pattern of reversal. This is the only year where the cumulative abnormal return (following the shocks) appears to provide some support for the price reversal hypothesis as negative shocks are followed by positive returns. Panel D of Table 4 displays the annual distribution of the average post-negative shocks in the emerging markets. In the 1989-1994 period almost all the negative shocks are followed by substantial cumulative returns that go in the same direction. The largest 10-day cumulative abnormal returns occurred in 1994 when they reached -2.6 percent. In the last three years—1995-1997—of our sample period, the negative shocks are followed by positive returns, thus supporting the overreaction hypothesis.

Previous studies show that price reversals may be driven by the month of the year (e.g. Jones (1987)). In particular, if all the abnormal price changes occur in January, the results will be driven by the so-called January effect. The monthly distribution of the shocks using all cases is reported in Table 5. In Table 5 we report the full results. Table 5 shows that, in both markets, the positive and the negative shocks are distributed evenly across the months of the year. The cumulative abnormal returns are, again, not month of the year dependent. The post-positive (negative) cumulative abnormal returns are always larger (more negative) in emerging markets relative to developed markets.

Table 5: Monthly distribution of post-positive and post-negative shock cumulative abnormal returns

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Panel A: Positive Shocks - Developed Markets												
Number (%)	91 (12.9)	37 (5.2)	37 (5.2)	55 (7.8)	60 (8.5)	33 (4.7)	83 (11.8)	63 (8.9)	41 (5.8)	65 (9.2)	56 (7.9)	85 (12.0)
Average	2.805	2.355	2.395	3.195	1.851	1.832	1.725	2.177	2.880	2.418	2.387	1.972
CAR 1	0.101	0.142	0.084	0.321	0.354	0.348	0.354	0.534	-0.150	0.418	0.430	0.334
CAR 3	0.113	0.238	0.424	1.058	0.881	0.457	0.597	0.768	-0.096	0.627	0.321	0.586
CAR 5	0.240	0.805	0.606	1.153	1.213	0.505	0.637	0.788	0.263	0.595	0.561	0.959
CAR 10	1.078	1.360	0.694	1.814	1.537	0.539	0.747	0.834	-0.293	0.523	0.294	1.295
Panel B: Positive Shocks - Emerging Markets												
Number (%)	65 (9.9)	52 (8.0)	34 (5.2)	43 (6.6)	62 (9.5)	49 (7.5)	59 (9.0)	59 (9.0)	48 (7.3)	60 (9.2)	62 (9.5)	61 (9.3)
Average	3.182	3.445	3.549	3.057	2.686	3.557	2.972	2.667	3.333	3.708	3.033	3.095
CAR 1	0.795	0.803	0.618	-0.065	0.843	0.740	0.586	0.805	0.854	0.866	0.424	0.324
CAR 3	1.466	1.087	1.242	0.195	1.566	1.526	1.422	1.275	1.135	1.502	0.990	0.783
CAR 5	2.171	1.208	2.018	0.477	2.050	2.490	1.401	1.017	1.256	1.239	0.965	1.305
CAR 10	3.558	1.737	1.964	1.222	2.523	3.174	1.168	1.264	1.190	0.672	2.261	2.183
Panel C: Negative Shocks - Developed Markets												
Number (%)	67 (7.9)	63 (7.4)	70 (8.3)	60 (7.1)	53 (6.3)	83 (9.8)	76 (9.0)	111 (13.1)	70 (8.3)	97 (10.7)	54 (6.4)	49 (5.8)
Average	-2.224	-1.917	-2.136	-2.080	-1.907	-1.945	-1.697	-2.930	-1.810	-3.188	-1.986	-2.235
CAR 1	-0.096	-0.037	-0.257	-0.248	-0.061	-0.192	-0.349	-0.325	-0.160	0.303	-0.170	0.358
CAR 3	0.015	-0.649	-0.654	0.052	-0.197	0.003	-0.311	0.026	-0.580	-0.252	-0.122	0.426
CAR 5	0.017	-1.181	-0.701	0.496	-0.338	-0.226	-0.891	0.169	-0.692	0.240	-0.359	0.649
CAR 10	0.597	-1.716	-0.963	0.624	-0.286	-0.231	-1.922	-0.442	-1.777	-0.266	-0.425	1.113
Panel D: Negative Shocks - Emerging Markets												
Number (%)	62 (10.5)	44 (7.4)	43 (7.2)	47 (8.0)	37 (6.3)	56 (9.5)	45 (7.6)	65 (11.0)	44 (7.4)	54 (9.1)	60 (10.2)	34 (5.8)
Average	-3.108	-3.617	-3.600	-3.304	-3.483	-2.393	-2.401	-3.352	-2.841	-3.587	-3.723	-2.833
CAR 1	-0.662	-0.832	0.098	0.178	-0.092	0.131	-0.650	-0.981	-0.212	-0.119	-0.406	0.335
CAR 3	-0.605	-1.083	0.310	0.341	0.237	-0.429	-0.638	-0.837	-0.171	-0.029	0.3443	0.500
CAR 5	-0.858	-1.510	0.713	-0.202	0.160	-0.791	-0.778	-0.722	-0.563	0.312	-0.167	0.047
CAR 10	-0.808	-3.623	-0.313	-1.552	0.211	-1.311	-1.779	-1.385	-0.422	-0.569	-0.144	2.174

7 Market reaction and shock level

Table 6 reports the results of the regressions of the various cumulative abnormal returns against the level of the shock for each market using only the non-overlapping cases. The results reported in Panel A indicate that, for both developed and emerging markets, the cumulative abnormal returns are not always strongly related to the levels (or size) of the shocks. Although the coefficients are positive, suggesting that positive abnormal returns follow positive shocks, their level of significance is not always high. For the developed markets, the high significance is limited to the 5 and 10-day CARs. For the emerging markets, only the first day abnormal returns are significantly related to the levels of the shocks.

Table 6: Regressions

Panel A: Positive Shocks		
Developed Markets n = 706		
	Regression Coefficient	**t-stat**
1 Day CAR	0.022	0.635
3 Day CAR	0.016	0.298
5 Day CAR	0.178	2.348
10 Day CAR	0.308	2.676
Emerging Markets n = 654		
1 Day CAR	0.067	1.977
3 Day CAR	0.026	0.424
5 Day CAR	0.082	0.986
10 Day CAR	0.064	0.521
Panel B: Negative Shocks		
Developed Markets n = 847		
1 Day CAR	-0.259	-8.187
3 Day CAR	-0.513	-9.982
5 Day CAR	-0.757	-13.153
10 Day CAR	-0.627	-7.793
Emerging Markets n = 591		
1 Day CAR	-0.106	-2.395
3 Day CAR	-0.342	-4.463
5 Day CAR	-0.505	-5.178
10 Day CAR	-0.503	-3.649

In contrast, the results reported in Panel B suggested that all the post-event cumulative abnormal returns are significantly related to the level of shocks. That is, larger single day shocks are followed by further price declines in the following five trading days.

8 Conclusions

In this paper, we test the over-reaction hypothesis using daily data from a large number of developed and emerging markets. In contrast to many previous studies, our results do not support the price reversal hypothesis. We show that, for both developed and emerging markets, the post-positive shocks are followed by subsequent large positive abnormal returns and the post-negative price shocks are followed by negative abnormal returns. As expected, we find strong differences across the two types of market. The magnitude of the shocks is significantly large in the emerging markets. In addition, the cumulative abnormal returns following the positive shocks (but not the negative ones) are substantially larger in the emerging compared to the developed markets. We show that both types of shock and the cumulative abnormal returns are relatively evenly distributed across the years of our sample period. In addition, we show that the results are not driven by the month effect. In general our findings are inconsistent with DeBondt and Thaler (1985). They are consistent with Cox and Peterson (1994) who also found that prices tend to decline after large negative shocks.

The puzzling price pattern following a major price shock may be explained by a rapid transmission of information. The sharp increase or decrease serves as a signal. The new information that caused a large advance or decline in the price level leads to gradual after-shock in the same direction. Not all participants react in the first day. This results in an apparent "trend chasing" process that continues for a few more days.

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