What Caused the 1987 Stock Market Crash and Lessons for the 2008 Crash*

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Abstract: We review an argument the cause of the stock market crash in 1987, update the empirical support for that argument, and compare recent market developments. While the market crash on October 19, 1987 was the largest one-day S&P 500 drop in percentage terms in history (20.47%) there was also a large market drop (more than 10.4%) in the three trading days before the 1987 crash. Mitchell and Netter (1989) show that the three-day decline was the largest in more than 40 years, large enough that the drop was news itself (the October 16th drop immediately before the crash was also an extremely large one-day decline). The theoretical model of Jacklin, Kleidon, and Pfleiderer (1992) shows how a surprise significant drop in the market could have provided information to the market that could directly lead to an immediate crash. Here we follow the stock market for 20 years after 1987, and find the magnitude of the market decline immediately preceding October 19, 1987 was still a significant outlier -- only one three-day period in the 20 years after 1987 had as large a market decline. We also document the large market movements and volatility in the period beginning in October 2008 and suggest that this volatility is different than what occurred in 1987.

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The cover story from the *Newsweek* (1987) issue that was released the weekend directly before the October 19, 1987 crash was titled "Is the Party Over?" The second paragraph of the article starts, "The cascading Dow and record trading volume marked a major shift in psychology and sent a powerful shiver across the country,"

-- Dentzer, Thomas, Wang, and Friday (1987).

1. Introduction

On Monday October 19, 1987, the U.S. equity market suffered its largest single-day percentage decline in history. The S&P 500 index fell by 57.86 points, a decline of 20.46%. The Dow Jones Industrial average suffered a similar decline, falling by 508 points, 22.6% of its value. The NASDAQ fell by 46 points, 11.35% of its value (although many of the dealers stopped trading early, limiting the reported decline). An important, but often forgetten, factor in this decline was the 10.12% decline in the S&P 500 in the three trading days prior to October 19.

Mitchell and Netter (1989) argue that this three-day decline was an important contributing factor to the crash – in fact, they describe the decline as a "trigger." In this paper, we review this argument, provide simple descriptive evidence supporting the argument and suggest how October 1987 is different from the market decline in late 2008. We report data that the drop in the stock market immediately proceeding the October 19, 1987 crash that others have shown was very large in historical terms remains one of the largest declines over the next 20 years. Additionally, we document the unprecedented level of volatility since August 2008 and show how it is different from 1987.

The October 19, 2007 market crash of more than 20% did not seem to be related to any fundamental news. However, Mitchell and Netter (1989) argue that the three-day decline preceding the crash was a large enough decline that it became the fundamental news and that shook the market. The theoretical model of Jacklin, Kleidon, and Pfleiderer (1992) (among others) shows how a surprise significant drop in the market could have provided information to the market that would directly lead to a crash. In this paper, we present evidence that even 20 years later, the magnitude of the market decline immediately preceding the 1987 is still a significant outlier – only one three-day period in the 20 years after 1987 had as large a market drop.

Jacklin, Kleidon, and Pfleiderer's model suggests that the sharp market decline preceding the 1987 crash revealed the effects of new investment strategies by investors that had not been fully anticipated by the market (they build on Grossman's (1988) model of the effects of imperfect information about portfolio insurance). This revelation to investors of the extent of dynamic hedging caused investors to dramatically revise downward their stock valuations. Other explanations of the 1987 crash include liquidity problems (the Presidential Task Force (1988) --The Brady Report) in trading when volume increased tremendously (perhaps as the result of portfolio insurance trading), or changed investor psychology or some combination of all the theories. However, each of the theories is consistent with the effects of a large downward market movement directly preceding the crash that was significant and unexpected, triggering the October 19 crash.

The paper proceeds as follows. In Section 2, we examine possible reasons for the 1987 crash, providing a general discussion on what causes large market movements, and reviewing the Mitchell and Netter work on the 1987 crash. In Section 3, we examine

trading volume and market volatility since the 1987 crash, including the extraordinary market events of the Fall of 2008. We conclude in Section 4.

2. Explanations for the October1987 Crash

There are at least three general views of the causes of the stock market crash on October 19, 1987. The views are not mutually exclusive. One is the efficient market story – the market reacted to some fundamental news that led market participants to revalue stocks down by more than 20% in one day. A second is a liquidity story – for some reason, probably a large number of sell orders, liquidity declined significantly, depressing prices. A third is some variant of a behavioral finance story – investors acting irrationally either drive prices up too high, followed by a significant fall, or panic and sell for some reason, significantly depressing prices.

2.1. Explanations of large market-wide stock-price movements

Cutler, Poterba, and Summers (1989) analyze the question of what fundamentally causes large stock price movements in a paper that followed soon after the 1987 crash. Their general conclusion is that we are not very good at explaining large stock price movements, questioning the "efficiency" of the market. They first consider the impact of macroeconomic news on the stock market. The paper considers such macroeconomic fundamentals as dividend payments, industrial production, real money supply, long and short-term interest rates, inflation and stock market volatility. They conclude that these macroeconomic variables are not statistically meaningful in explaining stock market returns.

Cutler et. al. also conduct a less formal analysis of the impact of "big news" on the stock market. Using the World Almanac as a source of significant news stories, the

paper narrows its selection of "big news" to those stories which were featured on the front page of the New York Times or were the lead story in the business section of the paper. Few if any of the stock market returns on these days are comparable to the returns seen in October 1987. The paper then reverses the analysis, examining the largest single-day movements of the S&P 500 index and examining the New York Times for an explanation of the event. The explanation they find for the October 19th, 1987 crash is "Worry over dollar decline and trade deficit; Fear of U.S. not supporting the dollar."

Cutler et al. conclude that it is difficult to explain large price movements even after the fact. An interpretation of their results is that if one cannot explain market movements after the fact, when news has been revealed, and markets do not move much in response to large news stories, it is difficult to argue that fundamentals drive markets, at least in the time of extreme movements.

Haugen, Talmor, and Torous (1991) perform a similar analysis, but focus on stock market volatility rather than returns. The authors document the largest single day shifts in stock market volatility and search for contributing explanations. When the authors are able to match large increases in volatility with a well-documented event, the event tends to be an act of warfare, a natural disaster or an assassination. The paper also notes that large decreases in volatility can generally be matched to political enactments or proclamations. This latter finding suggests a possible role for regulatory entities in 'calming' markets during volatile times.

2.2 Cause of the market decline October 14th -16th, 1987

Mitchell and Netter (1989) provide a case study of one market movement in contrast to the more general but less detailed analysis of Cutler et al. Mitchell and Netter

provide both cross-sectional and time series evidence supporting their hypothesis that the October 13-16 market decline was due to an unexpected proposal in the House Ways and Means Committee to end the tax deductibility of debt used in takeovers. Noting that the October 14-16th period represented the largest one-, two- and three-day declines (-5.16%, -8.11% and -10.44% respectively) since the French armies defensive position was unexpectedly compromised in May 1941, the paper examines the possible causes of this decline. The paper concludes that the market reacted negatively to news that a bill ending the interest deductibility of debt in takeovers was unexpectedly proposed by the U.S. House Ways and Means Committee and was likely to pass. Therefore, it was the prospect of this bill being signed into law that may have caused the market decline of 14-16th October, which then led to the subsequent more drastic decline on Monday 19th.

On the night of October 13th, 1987 the House Ways and Means Committee introduced a tax bill that had several provisions designed to restrict takeovers, especially ending interest deductions on debt used to acquire over 20% of a target's stock or assets. Given the Democratic control of the House and Senate, there was a very real possibility that the bill would pass. Mitchell and Netter identify five dates and precise times when new information on the bill reached the market. The market reacted negatively when the news of the bill progressing reached the market and positively when late in October Congress backed off. In addition, the cross-sectional and microstructure movements went in the predicted ways. All of their tests support the premise that the tax legislation was key to the stock market decline in the three trading days before the market crash. Further, they present evidence that it is unlikely that other news, including the trade deficit, caused the decline.

Two other papers, Miller and Mitchell (1999) and Mitchell, Pedersen, and Pulvino (2007), examine in more detail how the news about the tax could have caused a major decline in the market. Miller and Mitchell (1999) examine whether fundamental news could conceivably explain the market movements of October 1987 and show that fairly modest changes in expected future cash flows or discount rates can result in large market revaluations. The authors state, "while it might first seem that one should be able to identify the shocks to fundamental factors that can cause such a dramatic price decline, the above analysis suggests that these shocks do not necessarily have to be dramatic themselves." Mitchell, Pedersen, and Pulvino (2007) analyze how costly arbitrage mispricing "can be large and can extend for a long period." They consider several examples, include the stock market crash. They show how the tax bill caused merger arbitragers to sell on October 14th through the 16th and the selling increased on the 19th accelerating the price decline.

Roll (1989), however, argues that the international nature of the decline over the weekend of October 17th and 18th is not consistent with the takeover-tax story. Mitchell and Netter note however that the world decline occurred after the U.S. decline and was much smaller in magnitude (an equally weighted world index fell 2.03%). Further, as we discuss below, the world movement may be consistent with the trigger story told my Mitchell and Netter – the large three-day decline started the whole market downward.

2.3 The importance of the market decline before October 19, 1987

Grossman (1988) models a situation where the amount of dynamic hedging undertaken by traders is not public knowledge until they trade on these strategies. When coordinated selling occurred based on these strategies (e.g., during a big market decline)

liquidity issues will further depress the market. Grossman notes that if there were more dynamic hedging strategies in place than anticipated by traders, traders might be unable to execute all the dynamic hedging they had planned, increasing market volatility. Jacklin, Kleidon, and Pfleiderer (1992) also address the situation where a market has underestimated the amount of dynamic hedging strategies such as portfolio insurance, and the true amount if the hedging is revealed. However, unlike Grossman they concentrate on the effect the revelation of the information about the extent of dynamic hedging will have on traders' valuation of securities. In this case, the market will decline to reflect the information that the market was overvalued. Jacklin et al. note the large decline on October 16th fits with their model. While the liquidity problems pointed out by the Brady Commission (1988) and Grossman played a role in the crash, it is unlikely they were enough to cause the crash on their own.

3. Large Market Movements since 1950

In this section we report on market movements and volatility since 1950, concentrating on evidence post-1987. Our goal is two-fold. First, we provide evidence that supports the argument that the market drop in the trading period immediately before the 1987 crash was an unusually large decline. Second, we report recent evidence on the unprecedented nature of the September - November 2008 "crash." Note here our single most important piece of evidence (contained in Table 3) about the 1987 crash is that the magnitude of the three-day decline immediately preceding the 1987 crash was larger than any three-day decline in the twenty years after the 1987 crash.

The years since the market crash of October 1987 have served to further strengthen the argument that the October 14th -16th period saw an unusually large market

decline, which then precipitated the crash on Monday, October 19th. While the twenty years since the crash have seen the volume of trading on the NYSE increase dramatically, and while there have been episodes or days with large market movements, the October 14-16th 1987 period still ranks high amongst periods of severe market decline. While an argument can be made that the infrastructure of the market has improved over the last twenty years so that the market is better able to cope with episodes of high volume and illiquidity, it is also fair to say that the three days preceding Monday October 19th 1987 remain an extraordinary period of decline in the history of the stock market. In this section we explore both of these issues: the volatility and resiliency of the market since the crash, and the historic nature of the 14th-16th October 1987 period, which preceded the crash.

3.1 Volatility and Volume

Table I indicates the largest single-day negative returns for the S&P 500 index since 1950, but prior to September 2008. As one can see, there are nine days (excluding October 19, 1987) on which the market suffered a greater decrease than October 16th 1987. However, these decreases were not followed by the kind of crash seen in October 1987. Indeed, with only one exception, the market rebounded on the following days, as indicated in the table. The story is somewhat different for the market conditions seen since September 1st 2008, but this period in the market is addressed in greater detail in section 3.2.2.

Table A of the Appendix further illustrates this point. The Table highlights all the single days since 1987 in which the market (as measured by the S&P500 Index) declined by 3% or more. Note that in this table the period since the end of August 2008 is

considered separately. As of November 30th 2008, there had been 51 such negative-return days (less than 3%), and 20 of these days have occurred since the beginning of September 2008. Furthermore, there were 121 two-day periods between January 1988 and November 30th 2008 which saw the market cumulatively return -3% or less. The number of three-day periods where the market fell by 3% or more during this same period is 216. In other words, the market has certainly seen significant swings since October 1987, but without generating another similar crash.

Notable features of the October 1987 market crash are the volume of trading and the level of volatility exhibited by the market. Figure 1 illustrates the time series of daily trading volume from January 1968 to December 1987. It illustrates the dramatic spike in volume of trading on the 19th and 20th of October 1987. On these two days the volume of trading was $604,300,032 and $608,099,968 respectively, far greater than the more usual range of $140 million to $180 million exhibited for most of that year. Significantly, the days prior to the crash on Monday October 19th also saw comparatively large volumes of trading. October 15th and October 16th saw volume reach $263,200,000 and $338,500,000 respectively. Nothing prior to October 1987 even comes close to matching the volume on these two days.

The unusually high levels of trading in October 1987 are again illustrated in Figures 2a and 2b, which uses October 1987 as a starting point and charts the daily volume of trading in S&P 500 stocks until November 30th, 2008. Although there is a clear upward trend in the volume of trading over time, it was not until 15th December 1995 that trading volume reached the single day level of 19th October 1987, and not until 1997 that such daily volumes became common.

Since 1987, noticeable spikes in trading volume have been observed on several days:

- 4th January 2001: volume reached $2,131,000,064 as the S&P returned -1.06%. This followed a relatively large rise in the market on 3rd January of 5.01% (volume of $1,880,700,032)
- 1st September 1998: volume reached $1,216,600,064 as the S&P returned 3.86%. This followed a relatively large fall in the market on 30th August of -6.80% (volume of $917,500,032)
- 28th October 1997: volume reached $1,202,550,016 as the S&P returned 5.12%. This followed a relatively large drop in the market on 27th October of -6.87% (volume of $693,729,984)
- 16th August 2007: volume reached $6,509,300,000 as the S&P returned 0.32%. This followed a relatively large drop in the market on 14th and 15th August of -1.82% and -1.39% respectively (volume of $3,814,630,000 and $4,290,930,000)
- 18th September 2008: volume reached $10,082,689,600 as the S&P returned 4.33%. This followed a relatively large drop in the market on 17th September of -4.71% (volume of $9,431,870,400)

These final cases show that four of the most noticeable spikes in volume during this period came on the days after a large market decline. However, these volume spikes were not associated with market declines themselves.

Figure 3 illustrates the monthly variance of the S&P 500, using daily realized returns to compute the measure. October 1987 stands out as the most volatile month of trading during the period covered (January 1950 to November 30th 2008). It is also

interesting to note that the second half of the 1990's saw increased levels of stock market volatility, although no period has ever approached the level of October 1987. Market volatility over the September-November 2008 period saw levels of volatility to rival October 1987. Further discussion of this period follows in section 3.2.2.

Table II reports the most volatile months of trading in the S&P 500 since January 1950. October 1987 is the most volatile month of trading over this period, but all other months except one listed on the table have occurred since October 1987. Once again this is an indication that the market has been comparatively volatile in periods since October 1987, without producing the crash seen in 1987. Even so, prior to September 2008, no other month on this list had exhibited even half the level of volatility of October 1987.

Events in September 2008 and since, related to the so-called "subprime crisis", have produced a highly volatile market. The week of the 15th to 19th of September 2008 saw well-established firms such as Merril Lynch, AIG and Lehman Brothers reveal deep financial troubles within their operations. This followed on the heals of publicly revealed financial difficulties for Fannie Mae and Freddie Mac, which saw the Federal government promise taxpayer-funded assistance estimated to be as much as $100 billion for each entity (Labaton and Andrews, 2008). The months of September, October and November 2008 exhibited historic levels of volatility, even though they did not eclipse October 1987. We will have more to say on the market volatility of these three months in section 3.2.2.

3.2 October 14th-16th 1987 in historical context: the following twenty years

Despite this evidence that the stock market has recently exhibited comparatively high volatility and large single-day movements, Table III (a) illustrates how truly

extraordinary the market movements of October 14th – 16th 1987 were. Table III (a) reports the 10 largest 3-day cumulative decreases in the S&P 500 in the years after October 1987, starting from November 1st, 1987. Data for the three months starting at the beginning of September 2008 is presented separately.

As reported in Mitchell and Netter (1989), the decline in the value of the stock market between the 14th and 16th of October was the largest 3-day decrease since the Second World War. Table III (a) illustrates that despite the recent increases in trading volume and the relatively high levels of market volatility from 1997 to 2003, 3-day declines of similar magnitude were rare in the twenty years following the Crash. Only one period, in late August 1998 outpaces the steep market decline of 14-16th October 1987. The August 1998 period relates to the Russian default/Long Term Capital Management crisis.[1]

Prior to the October 1987 crash, 3-day negative cumulative returns in the order of magnitude of those documented above were rare. Periods of decline which rivaled October 14th -16th 1987 were largely confined to the Great Depression years of 1929-1933. As reported in Mitchell and Netter (1989) the largest 3-day decline in the stock market prior to the 1987 crash occurred in May of 1940 "when German tanks broke through the French armies, sealing France's fate in World War II."

Table III (b) reports the largest 3-day declines since 1950, but prior to October 1987. No 3-day period rivals October 14th -16th 1987, and only one 3-day period listed in this table even makes the top 10 list reported in Table III (a) (excluding the post-August

[1] See Lowenstein (2000) for a colorful account of this episode in the market, and its effect on the hedge fund Long Term Capital Management (chapter 7 in particular).

2008 data). Taken together, Tables III (a) and III (b) highlight how large the market decline of October 14th -16th 1987 was historically.

3.3 Market Crisis of Fall 2008

The evidence clearly shows that the three trading days prior to the crash on Monday 19th October 1987 saw a historically large market decline. This continues to be true even with twenty additional years of data since the data considered in Mitchell and Netter (1989).

However, market conditions in late 2008 have seen market declines and volatility which rival, and in some cases surpass, those of October 1987. In fact, the recent market conditions only serve to confirm how extraordinary October 1987 was. Table I includes Post-August 2008 data for the largest single-day negative returns on the S&P 500. Two things are worth noting. First, there were a comparatively large number of significant single-day market declines in the fall of 2008. Many days from September, October and November would rank near the top of the list of largest single-day negative returns on the S&P 500 since 1950. Secondly, none of these single-day declines comes close to that seen on Monday 19th October 1987. Therefore, the data shows that the fall of 2008 was a particularly bad time for the market, but that the market crash of October 1987 is still unique.

However, Table III illustrates that the market crisis of fall 2008 has produced 3-day declines comparable to 14th -16th October 1987. In particular, the early part of October 2008 saw three 3-day declines larger than 14th -16th October 1987, all in a similar, over-lapping period. Specifically these periods were 3rd -7th, 6th -8th and 7th -9th of

October 2008. The decline over the 18th -20th November period was also noticeably large.

In general, the months of September, October and November 2008 saw an unusually high number of significant 3-day declines. The magnitude of the decline over the 14th -16th October 1987 period is still historically high, however, even though it has since been joined by other comparable 3-day declines. The fact that none of these more recent 3-day declines triggered a market crash similar to 19th October 1987 reinforces the notion that the market is now different to how it was back in 1987.

Table II provides evidence on just how volatile the market conditions of fall 2008 have been. In terms of day-to-day closing levels of the S&P 500, the volatility exhibited in September, October and November 2008 are historically high. The standard deviation of intra-month daily returns shows that these months rank 4th, 2nd and 3rd respectively on the list of most volatile months of trading in the market since January 1950. However, importantly, October 1987 still remains at the top of the list as the most volatile month of trading in the market since 1950.

The market crisis of 2008 has clearly led to sustained levels of high market volatility, as shown by the high ranking of all months in this period on Table II. To some extent this was also true of the 1987 crash. The subsequent months in 1987 also saw comparatively high levels of volatility, although not on the same scale as September-November 2008. November 1987, December 1987 and January 1988 saw the following levels of intra-month volatility: 1.84%, 1.77% and 2.18%. These levels would rank 20th, 23rd and 9th on the updated post-1950 list of monthly volatility. February 1988 saw a

return to less volatility; it's level of 0.99% ranks 160th. It remains to be seen what will happen to the market in this current crisis.

4. Conclusion

In this paper we use the twenty years since the market crash of October 1987 to further strengthen the argument that the period immediately before the crash (October 14-16th) period saw an unusually large market decline. We review the arguments that this initial market decline of 14th – 16th October precipitated the crash on Monday, October 19th. We argue that the news of the large three-day drop from the 14th to the 16th led to the crash on the 19th.

Mitchell and Netter (1989) perform a detailed case study analysis of the causes of the market decline from October 14th to the 16th. They argue that while several factors matter, the most important was a proposed tax bill that would have sharply restricted the takeover market by, among other things, ending the interest deductibility of debt used in takeovers.

There are several theories on how the large three-day decline could lead to a crash on the next trading day (October 19th). They center on the idea that either a significant decline revealed negative information about the market, led to liquidity problems in trading, or changed investor psychology. However, the theories rest to some extent on the premise that the downward market movement was significant and unexpected.

Critical to all the theories is that the decline of over 10% in the three days before the crash was very unusual. Mitchell and Netter note it was the biggest one-, two-, or three-day decline since the unexpected victory of Germany over France in WW II. Here

we examine the twenty years since and find that the market decline the week before the crash was indeed an unusually large decline in market history.

While the twenty years since the crash have seen the volume of trading on the NYSE increase dramatically, and while there have been episodes or days with large market movements, the October 14th -16th 1987 period still ranks high amongst periods of severe market decline. While an argument can be made that the infrastructure of the market has improved over the last twenty years so that the market is better able to cope with episodes of high volume and illiquidity, it is also fair to say that the three days preceding Monday October 19, 1987 remain an extraordinary period of decline in the history of the stock market.

Finally, we suggest that the 1987 October Crash was caused by fundamentally different dynamics than the fall 2008 market decline. In the October 1987 crash, we review the argument that fundamental news moved the market down over 10%. This significant market decline changed traders' view of the viability of dynamic trading strategies, which affected market operations, causing a downward revaluation of stock prices and leading to a "crash" on October 19. In fall 2008, there was a significant stock market drop related to fundamental factors of the seizing up of the credit markets, major declines in the price of housing and resulting foreclosures, declines in the value of CMOs, and the extent of bank leverage, bank failures, bailouts, recession and overleveraging, but unlike 1987 there was little or no information revealed about the trading strategies of stock market participants. Thus, we should perhaps take little solace that within a year the market had recovered the value lost in the crash of 1987 and the crash was not followed by a recession. Things may be very different now.

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Table 1 Panel A: Largest single-day negative S&P 500 returns (Jan 1950-November 31st, 2008)

This table reports the largest single-day decreases for the S&P 500 index, and the performance of the index over the subsequent three days. *Date* is the trading day, *Return* is the trading day return based on the closing level the previous trading day and the closing level on the actual trading day, and $Return_{(t+n)}$ is the trading day return *n* days after the original trading day. The data are split into a Pre-August 2008 period, which covers the period from January 1st 1950 to August 31st 2008, and a Post-August 2008 period, which covers the period from September 1st 2008 to November 30th 2008. October 19th and 16th 1987 rank 1st and 11th respectively on the Pre-August 2008 list.

Date	Return	$Return_{(t+1)}$	$Return_{(t+2)}$	$Return_{(t+3)}$
January 1st 1950 - August 31st 2008				
19-Oct-87	-20.47%	5.33%	9.10%	3.92%
26-Oct-87	-8.28%	2.42%	0.04%	4.93%
27-Oct-97	-6.87%	5.12%	-0.29%	-1.68%
31-Aug-98	-6.80%	3.86%	-0.38%	-0.83%
8-Jan-88	-6.77%	1.68%	-0.84%	0.16%
28-May-62	-6.68%	4.65%	2.67%	-0.42%
26-Sep-55	-6.62%	2.28%	1.68%	-0.63%
13-Oct-89	-6.12%	2.76%	-0.49%	0.18%
14-Apr-00	-5.83%	3.31%	2.87%	-0.98%
26-Jun-50	-5.38%	-1.10%	1.12%	-3.70%
16-Oct-87	-5.16%	-20.47%	5.33%	9.10%
17-Sep-01	-4.92%	-0.58%	-1.61%	-3.11%
11-Sep-86	-4.81%	-1.92%	0.55%	-0.09%
14-Apr-88	-4.36%	0.01%	-0.22%	-0.50%
12-Mar-01	-4.32%	1.48%	-2.58%	0.59%
30-Nov-87	-4.18%	0.74%	0.62%	-3.53%
3-Sep-02	-4.15%	1.75%	-1.60%	1.68%
September 1st 2008 – November 30th 2008				
15-Oct-08	***-9.04%***	***4.25%***	***-0.62%***	***4.77%***
29-Sep-08	***-8.81%***	***5.27%***	***-0.32%***	***-4.03%***
9-Oct-08	***-7.62%***	***-1.18%***	***11.58%***	***-0.53%***
20-Nov-08	***-6.71%***	***6.32%***	***6.47%***	***0.66%***
19-Nov-08	***-6.12%***	***-6.71%***	***6.32%***	***6.47%***
22-Oct-08	***-6.10%***	***1.26%***	***-3.45%***	***-3.18%***
7-Oct-08	***-5.74%***	***-1.13%***	***-7.62%***	***-1.18%***
5-Nov-08	***-5.27%***	***-5.03%***	***2.89%***	***-1.27%***
12-Nov-08	***-5.19%***	***6.92%***	***-4.17%***	***-2.58%***
6-Nov-08	***-5.03%***	***2.89%***	***-1.27%***	***-2.20%***
17-Sep-08	***-4.71%***	***4.33%***	***4.03%***	***-3.82%***
15-Sep-08	***-4.71%***	***1.75%***	***-4.71%***	***4.33%***

Table 1 Panel B: Days post-1987 in which the S&P500 index has registered a decline of 3% or more

This table reports the details for each trading day on the S&P 500 since November 1st 1987 in which the return on that day was less than -3%. *Date* is the trading day, *Volume* is the trading volume in dollars, and *1-day Return* is the return for the trading day calculated from the previous trading day's closing level to the actual trading day's closing level.

Date	Volume	1-day Return
November 1st 1987 – August 31st 2008		
27-Oct-97	693,729,984	-6.8657%
31-Aug-98	917,500,032	-6.8014%
8-Jan-88	197,300,000	-6.7683%
13-Oct-89	251,170,000	-6.1172%
14-Apr-00	1,279,699,968	-5.8278%
17-Sep-01	2,330,830,080	-4.9216%
14-Apr-88	211,810,000	-4.3560%
12-Mar-01	1,228,999,936	-4.3181%
3-Sep-02	1,289,799,936	-4.1536%
27-Aug-98	938,600,000	-3.8370%
19-Jul-02	2,654,099,968	-3.8352%
4-Jan-00	1,009,000,000	-3.8345%
15-Nov-91	239,690,000	-3.6586%
4-Aug-98	852,600,000	-3.6245%
24-Mar-03	1,292,999,936	-3.5231%
27-Feb-07	4,065,230,000	-3.4725%
3-Apr-01	1,386,099,968	-3.4393%
5-Aug-02	1,425,500,032	-3.4296%
10-Jul-02	1,816,899,968	-3.3962%
22-Jul-02	2,248,059,904	-3.2911%
27-Sep-02	1,507,299,968	-3.2259%
5-Feb-08	4,315,740,000	-3.1995%
20-Dec-00	1,421,600,000	-3.1296%
20-Sep-01	2,004,800,000	-3.1060%
6-Jun-08	4,771,660,000	-3.0889%
8-Mar-96	546,550,016	-3.0827%
30-Sep-98	800,099,968	-3.0514%
18-Feb-00	1,042,300,032	-3.0376%
6-Aug-90	240,400,000	-3.0244%
1-Oct-98	899,699,968	-3.0108%
19-Sep-02	1,524,000,000	-3.0065%
September 1st 2008 – November 30th 2008		
15-Oct-08	***6,542,330,000***	***-9.0350%***
29-Sep-08	***7,305,060,000***	***-8.8068%***
9-Oct-08	***6,819,000,000***	***-7.6167%***
20-Nov-08	***9,093,740,000***	***-6.7123%***
19-Nov-08	***6,548,600,000***	***-6.1156%***
22-Oct-08	***6,147,980,000***	***-6.1013%***

7-Oct-08	*7,069,209,600*	*-5.7395%*
5-Nov-08	*5,426,640,000*	*-5.2677%*
12-Nov-08	*5,764,180,000*	*-5.1894%*
6-Nov-08	*6,102,230,000*	*-5.0264%*
17-Sep-08	*9,431,870,400*	*-4.7141%*
15-Sep-08	*8,279,510,400*	*-4.7136%*
14-Nov-08	*5,881,030,000*	*-4.1699%*
2-Oct-08	*6,285,640,000*	*-4.0291%*
6-Oct-08	*7,956,020,000*	*-3.8518%*
22-Sep-08	*5,332,130,000*	*-3.8237%*
24-Oct-08	*6,550,050,000*	*-3.4511%*
9-Sep-08	*7,380,630,400*	*-3.4138%*
27-Oct-08	*5,558,050,000*	*-3.1764%*
21-Oct-08	*5,121,830,000*	*-3.0800%*

Table 2: Most volatile months of trading in the S&P 500. Jan 1950 - Nov 2008

This table reports the most volatile months of trading in S&P 500 stocks since January 1950. The measure of volatility is standard deviation, calculated from daily realized close-to-close returns from within the calendar month. *Month* is the relevant calendar month, and *Standard Deviation* is calculated as: $\frac{\sum_{t=1}^{T}(R_t - \overline{R})^2}{T-1}$, where t is the relevant trading day within the month, T is the total number of trading days in the month, R_t is the return on trading day t, as measured from the previous day's closing level to day t's closing level, and *R-bar* is the average daily return within the calendar month.

Month	**Standard Deviation**
October 1987	***5.73%***
October 2008	4.98%
November 2008	4.36%
September 2008	3.33%
July 2002	2.66%
January 1988	2.28%
October 2002	2.24%
September 2001	2.20%
September 1998	2.19%
October 1997	2.19%
May 1962	2.13%
August 2002	2.11%
April 2000	2.11%
August 1998	2.07%

Table 3: Largest Three-Day Declines in the S&P 500 Post 1950

The following panels report the largest three-day declines for different time periods, with the three days prior to the October 19th 1987 crash serving as a benchmark. Three day decline is calculated as: $\left[\quad \right]$, where R_t is the return on the S&P 500 on day t, as measured from the previous day's closing level to the day t closing level.

Panel A: Largest 3-day cumulative decreases in the S&P 500 since October 1987

DATE	3-day Cumulative Return	
November 1st 1987 – August 31st 2008		
27, 28, 31 Aug 1998	-11.71%	
14, 15, 16 Oct 1987	**-10.12%**	**Three Trading Days Before Oct. 19, 1987**
12, 13, 14 Apr 2000	- 9.60%	
18, 19, 22 July 2002	- 9.51%	
19, 22, 23 July 2002	- 9.51%	
23, 24, 27 Oct 1997	- 9.45%	
1, 2, 5 Aug 2002	- 8.45%	
11, 12, 13 Oct 1989	- 7.76%	
19, 20, 21 Sep 2001	- 7.50%	
10, 17, 18 Sep 2001	- 7.31%	
25, 27, 30 Nov 1987	- 6.62%	
21, 22, 23 Aug 1990	- 6.51%	
1st September 2008 – 30th November 2008		
7, 8, 9 Oct 2008	-13.91%	
18, 19, 20 Nov 2008	-11.56%	
3, 6, 7 Oct 2008	-10.59%	
6, 7, 8 Oct 2008	-10.40%	
14, 15, 16 Oct 1987	**-10.12%**	**Three Trading Days Before Oct. 19, 1987**
8, 9, 10 Oct 2008	- 9.74%	
2, 3, 6 Oct 2008	- 8.97%	
10, 11, 12 Nov 2008	- 8.45%	
22, 23, 24 Oct 2008	- 8.20%	
21, 22, 23 Oct 2008	- 7.84%	
17, 18, 19 Nov 2008	- 7.64%	

Panel B: 10 Largest 3-day cumulative decreases in the S&P 500 before October 1987

DATE	3-day Cumulative Return	
January 1st 1950 – October 16th 1987		
14, 15, 16 Oct 1987	**-10.12%**	**Three Trading Days Before Oct. 19, 1987**
24, 25, 28 May 1962	- 9.18%	
10, 11, 12 Sep 1986	- 6.86%	
15, 18, 19 Nov 1974	- 6.65%	
23, 26, 27 Jun 1950	- 6.52%	
19, 20, 21 May 1970	- 6.24%	

Figure 1: Daily Volume of S&P 500 stocks (in Dollars) Jan 1st 1968 - Oct 31st 1987

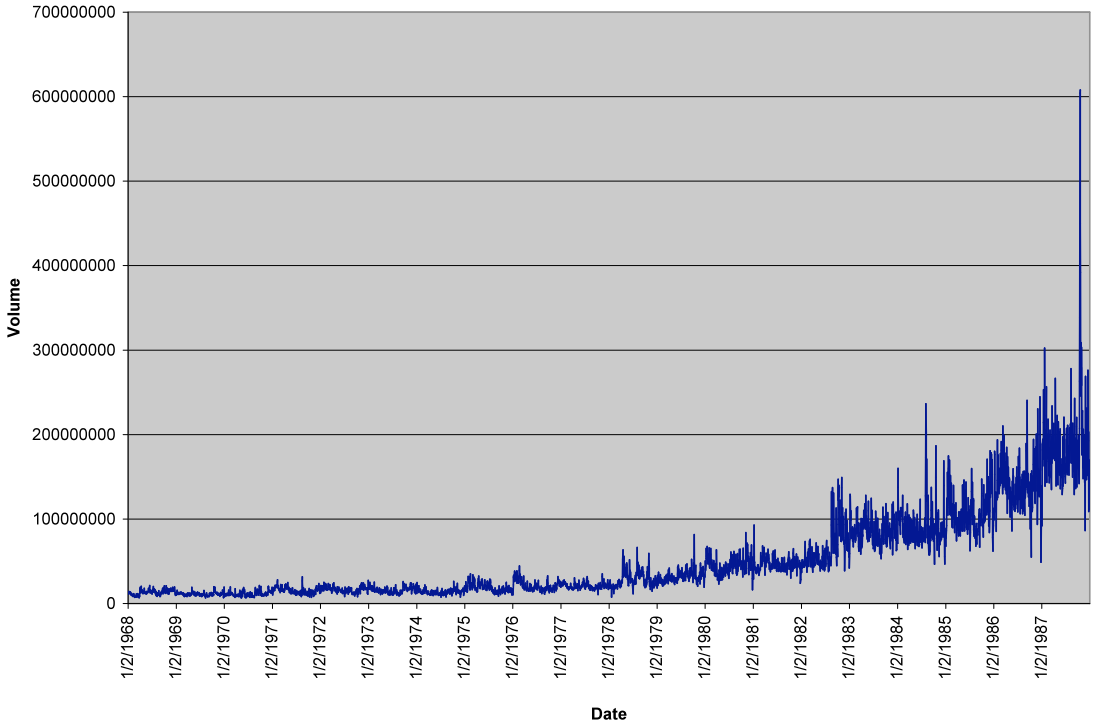

Figure 2a: Daily Volume of S&P 500 stocks (in Dollars) Oct 1st 1987 – Sep 30th 2001

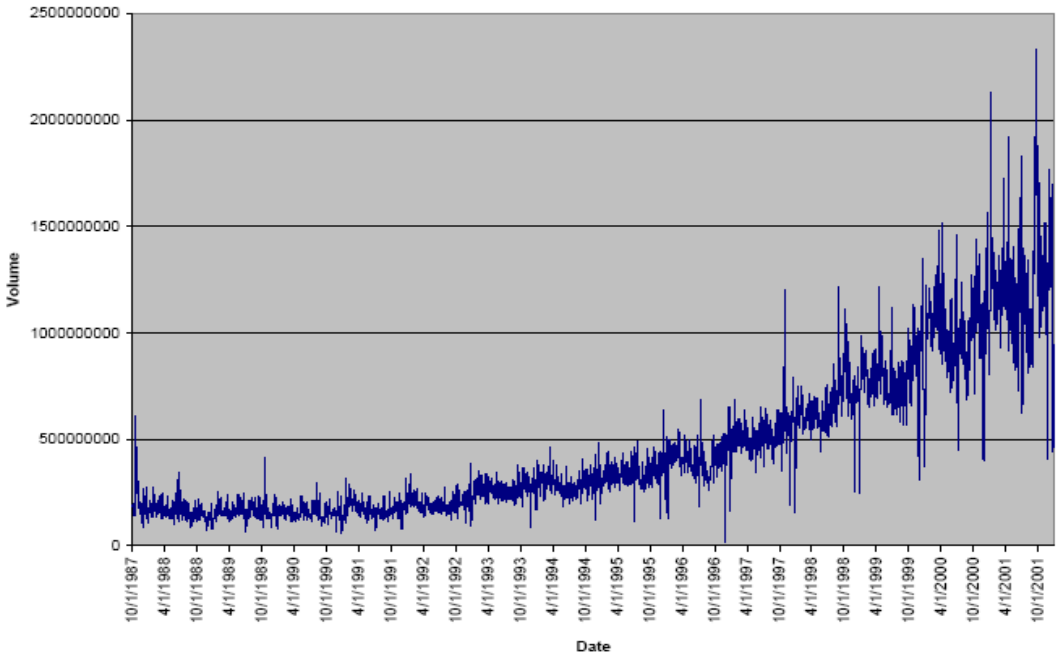

Figure 2b: Daily Volume of S&P 500 stocks (in Dollars) 1st Oct 2001 – 30th Nov 2008

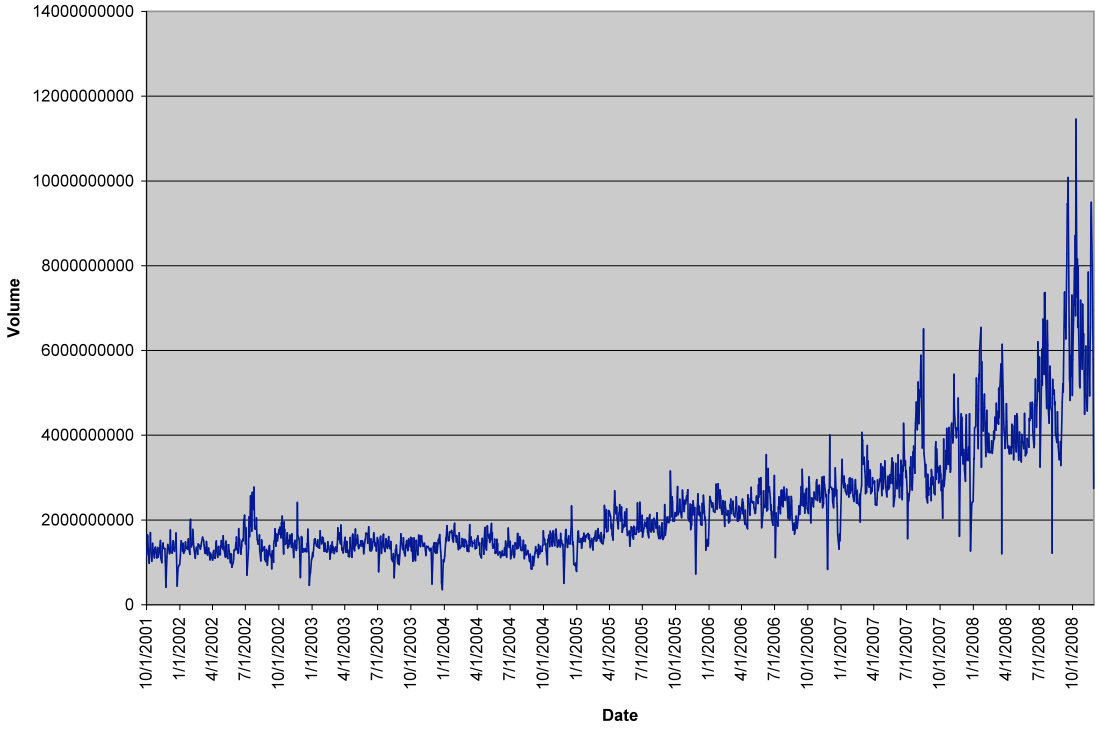

Figure 3: Monthly Volatility, as measured by standard deviation of daily close-to-close returns, of the S&P 500 January 1950 – November 2008