A Brief History of the 1987 Stock Market Crash with a Discussion of the Federal Reserve Response
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On October 19, 1987, the stock market, along with the associated futures and options markets, crashed, with the S&P 500 stock market index falling about 20 percent. The market crash of 1987 is a significant event not just because of the swiftness and severity of the market decline, but also because it showed the weaknesses of the trading systems themselves and how they could be strained and come close to breaking in extreme conditions. The problems in the trading systems interacted with the price declines to make the crisis worse. One notable problem was the difficulty gathering information in the rapidly changing and chaotic environment. The systems in place simply were not capable of processing so many transactions at once.[1] Uncertainty about information likely contributed to a pull back by investors from the market. Another factor was the record margin calls that accompanied the large price changes. While necessary to protect the solvency of the clearinghouse processing the trades, the size of the margin calls and the timing of payments served to reduce market liquidity. Finally, some have argued that "program trades," which led to notable volumes of large securities sales contributed to overwhelming the system.

The Federal Reserve was active in providing highly visible liquidity support in an effort to bolster market functioning. In particular, the Federal Reserve eased short-term credit conditions by conducting more expansive open market operations at earlier-than-usual times, issuing public statements affirming its commitment to providing liquidity, and temporarily liberalizing the rules governing the lending of Treasury securities from its portfolio. The liquidity support was important by itself, but the public nature of the activities likely helped support market confidence. The Federal Reserve also encouraged the commercial banking system to extend liquidity support to other financial market participants.[2] The response of the Federal Reserve was well received and was seen as important in helping financial markets return to more normal functioning.

The purpose of this paper is to provide a useful history of the 1987 stock market crash and the factors contributing to its severity and also to illustrate some of the tools the Federal Reserve has at its disposal to deal with financial crises. Section 1 of the paper provides some pertinent

[1] These systems have all been upgraded dramatically since the 1987 crash. Indeed, the crash may have provided some impetus for the upgrades.

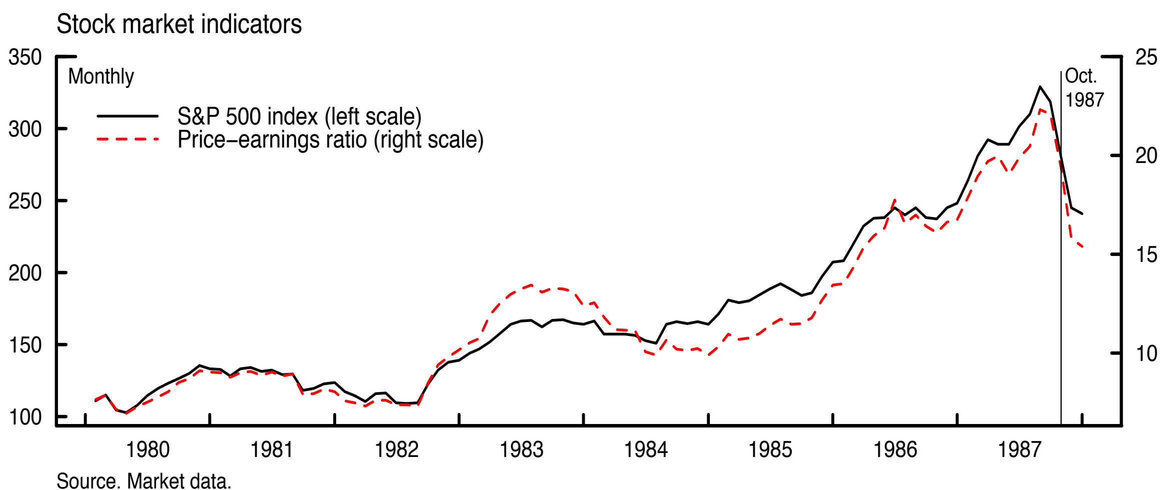
[2] These activities are discussed in Greenspan (1988).

background information on developments in equity markets and trading strategies preceding the crash. A timeline of the crisis is presented in Section 2. Section 3 discusses some factors that contributed to the severity of the crisis and that threatened market functioning. Section 4 details the actions taken by the Federal Reserve. Section 5 concludes.

1 Background

During the years prior to the crash, equity markets had been posting strong gains (see Figure 1). Price increases outpaced earnings growth and lifted price-earnings ratios; some commentators warned that the market had become overvalued (see for example Wall Street Journal (1987a) and Anders and Garcia (1987)). There had been an influx of new investors, such as pension funds, into the stock market during the 1980s, and the increased demand helped support prices (Katzenbach 1987). Equities were also boosted by some favorable tax treatments given to the financing of corporate buyouts, such as allowing firms to deduct interest expenses associated with debt issued during a buyout, which increased the number of companies that were potential takeover targets and pushed up their stock prices (Presidential Task Force on Market Mechanisms (Brady Report) 1988).

Figure 1:



However, the macroeconomic outlook during the months leading up to the crash had become somewhat less certain. Interest rates were rising globally. A growing U.S. trade deficit and decline in the value of the dollar were leading to concerns about inflation and the need for higher interest rates in the U.S. as well (Winkler and Herman 1987).

Importantly, financial markets had seen an increase in the use of "program trading" strategies, where computers were set up to quickly trade particular amounts of a large number of stocks, such as those in a particular stock index, when certain conditions were met.[3] There were two program trading strategies that have often been tied to the stock market crash. The first was "portfolio insurance," which was supposed to limit the losses investors might face from a declining market. Under this strategy, computer models were used to compute optimal stock-to-cash ratios at various market prices. Broadly, the models would suggest that the investor decrease the weight on stocks during falling markets, thereby reducing exposure to the falling market, while during rising markets the models would suggest an increased weight on stocks. Buying portfolio insurance was similar to buying a put option in that it allowed investors to preserve upside gains but limit downside risk. In practice, many portfolio insurers conducted their operations in the futures market rather than in the cash market. By buying stock index futures in a rising market and selling them in a falling market, portfolio insurers could provide protection against losses from falling equity prices without trading stocks. Trading in the futures market was generally preferred as it was cheaper and many of the institutions that provided portfolio insurance were not authorized to trade their clients' stock (Brady Report 1988, p. 7). Portfolio insurers did not continually update their analysis about the optimal portfolio of stocks and cash holdings, as the procedure was time consuming and transaction costs could add up with constant re-optimizing; instead, portfolio insurers ran the models periodically and then traded in batches (Garcia 1987). There were concerns that the use of portfolio insurance could lead many investors to sell stocks and futures simultaneously; there was an article in the Wall Street Journal on October 12 citing concerns that during a declining stock market, the use of portfolio insurance "could snowball into a stunning rout for stocks" (Garcia 1987).

[3] See also Katzenbach (1987), who provides a detailed description of the different types of program trading strategies described here.

The second program trading strategy was "index arbitrage," which was designed to produce profits by exploiting discrepancies between the value of stocks in an index and the value of the stock-index futures contracts. If the value of the stocks was lower than the value of the futures contract, then index arbitragers would buy the stocks in the cash market and sell the futures contract knowing that the prices would have to converge at the time the futures contract expired. The reverse transactions could be executed if the value of stocks was above that of the futures contract; however, rules restricting short-sales made this trade more difficult to implement for arbitragers that did not own stocks (Katzenbach 1987, p. 12).[4]

The use of program trading was facilitated on the New York Stock Exchange (NYSE) by the use of the designated order turnaround (DOT) system (Katzenbach 1987). This order processing system allowed NYSE member firms to transmit large volumes of buy and sell orders through their own connections to the NYSE common message switch and have them routed to a specialist/trading post.[5] If the specialist did not report execution of the trade within three minutes, the NYSE gave confirmation of execution at a reference price. If the trade was not made with a third party, then the trade was put on the specialist's account (Brady Report 1988, Study VI, p. 11). The automatic nature of the DOT system enabled it to handle the large number of trades needed for the successful implementation of program trading strategies.

2 Timeline of the crash

The review of the crash presented here focuses on developments at the NYSE and on the the Chicago Mercantile Exchange (CME) and the Chicago Board of Trade (CBOT), exchanges where options and futures for popular stock indexes, such as the S&P 500, were traded.[6]

[4]The Securities Exchange Act Rule 10a-1 prohibited short sales of the stocks when the bid price was lower than the last reported trading price.

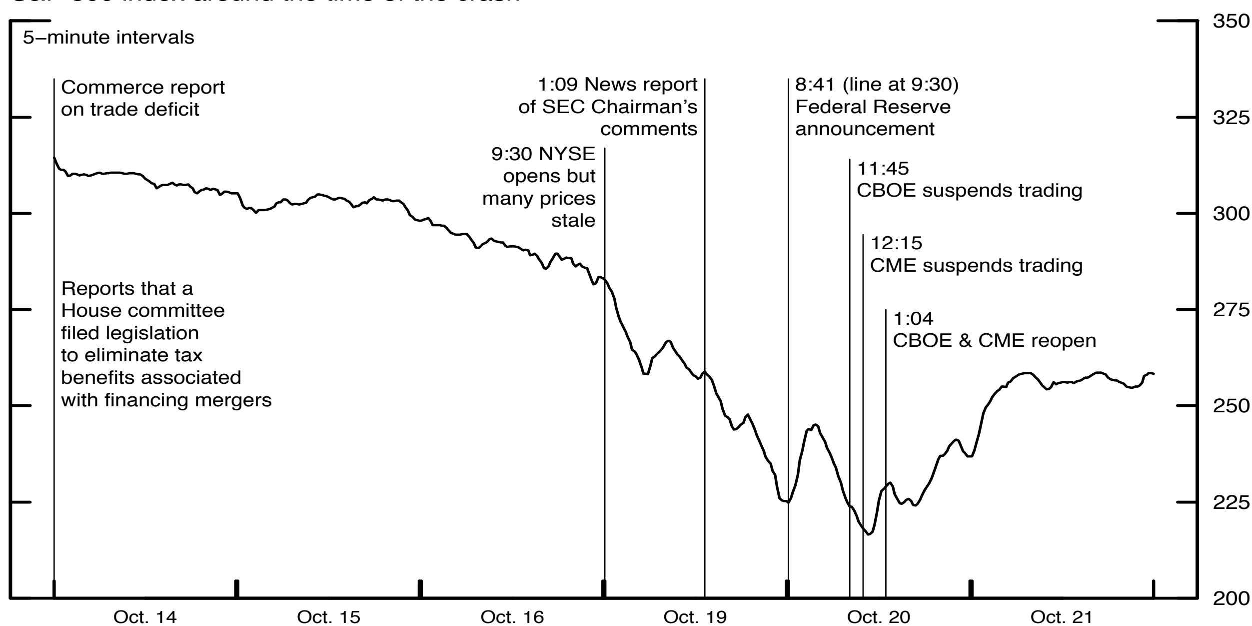
[5]A specialist at the NYSE is an exchange member in charge of making a market in a particular stock or stocks. All stocks are assigned to a specialist. The specialist has a monopoly on arranging the market for the stocks and in return has an obligation to make a market when there are order imbalances by buying/selling when there are numerous sell/buy orders from other market participants (Saunders and Cornett 2007, p. 259).

[6]There were also notable problems in the over-the-counter stock market. Market makers in the over-the-counter market were not obligated to maintain an orderly market and many withdrew from trading. Delays in processing trades resulted in investors receiving prices very different from what they expected. Many brokers did not answer

2.1 Wednesday, October 14 - Friday, October 16, 1987

Two events Wednesday morning have been pointed to as precipitating a decline in the stock market that continued for the rest of the week. First, news organizations reported that the Ways and Means Committee of the U.S. House of Representatives had filed legislation to eliminate tax benefits associated with financing mergers (Securities and Exchange Commission (SEC) Report 1988, p. 3-10).[7] Stocks' values were reassessed as investors reduced the odds that certain companies would be take-over targets. Second, the Commerce Department's announcement of the trade deficit for August was notably above expectations. On this news, the dollar declined and expectations that the Federal Reserve would tighten policy increased (Wall Street Journal 1987b). Interest rates rose, putting further downward pressure on equity prices (see Figure 2).

Figure 2:



their phones, leaving investors unable to reach them. Erratic price movements and quotes resulted in frequent lock-ups in the electronic trading system used in the over-the-counter market. For further details on the problems in the over-the-counter market see the discussion in the Brady Report (1998, Study VI, pp. 49-63).

[7] The proposal would have eliminated the tax deductions for some interest expenses and would have started taxing "greenmail"—payments made by companies to corporate raiders to buy back their stock at above-market prices to prevent the raider from taking over the company.

On Thursday, equity markets continued to decline. Some of this decrease was attributed to anxiety among institutions, especially pension funds, and among individual investors, which led to a movement of funds from stocks into the relative safety of bonds (Wall Street Journal 1987c). There was also heavy selling during the last half hour of the day amid heavier-than-usual activity by portfolio insurers (Brady Report 1988, p. 21).

Markets continued to decline on Friday, as ongoing anxiety was augmented by some technical factors. A variety of stock index options expired on Friday; price movements during the previous two days had eliminated many at-the-money options so that investors could not easily roll their positions into new contracts for hedging purposes. These developments pushed more investors into the futures markets, where they sold futures contracts as a hedge against falling stocks.[8] Increased sales of futures contracts created a price discrepancy between the value of the stock index in the futures market and the value of the stocks on the NYSE. Index arbitrage traders reportedly took advantage of this price discrepancy to buy futures and sell stocks, which transmitted the downward pressures to the NYSE (Brady Report 1988, Study III, p. 12).

By the end of the day on Friday, markets had fallen considerably, with the S&P 500 down over nine percent for the week. This decrease was one of the largest one-week declines of the preceeding couple of decades, and it helped set the stage for the turmoil the following week (Wall Street Journal 1987d). Portfolio insurers were left with an "overhang" as their models suggested that they should sell more stocks or futures contracts (SEC Report 1988, p. 2-10). Mutual funds experienced redemptions and needed to sell shares (Brady Report 1988, p. 29).[9] Further, some aggressive institutions anticipated the portfolio insurance sales and mutual fund redemptions and wanted to pre-empt the sales by selling first (Brady Report 1988, p. 29; SEC Report 1988, p. 3-12).[10] There were some signs that futures markets were already starting to feel the effects of

[8]This activity was similar to the technique used by portfolio insurers.

[9]The SEC (1988, pp. 2-17—2-18) indicated that these sales were largely attributable to one major mutual fund complex.

[10]While there were some concerns about institutions frontrunning customer accounts during the crash (see SEC Report 1988, pp. 3-30—3-33), that need not be the case described here. Institutions with knowledge of how portfolio insurance models worked, or that read newspapers with stories of investor concern about the market decline (for instance the Wall Street Journal (1987c, Oct. 16)), may well have guessed that other institutions would be entering

heavier-than-usual volumes, with traders on the Chicago Mercantile Exchange (CME) meeting on Saturday to try to settle positions and sort out holdings (Wall Street Journal 1987d).

2.2 Monday, October 19, 1987

There was substantial selling pressure on the NYSE at the open on Monday with a large imbalance in the number of sell orders relative to buy orders (SEC Report 1988, p. 2-13). In this situation, many specialists did not open for trading during the first hour.[11] The SEC noted "by 10:00, 95 S&P stocks, representing 30% of the index value, were still not open" (1988, p. 2-13); the Wall Street Journal indicated that 11 of the 30 stocks in the Dow Jones Industrial Average opened late (1987e). The values of stock market indicies are calculated using the most recent price quotes for the underlying stocks. With stocks not trading, some of the quotes used to construct market indexes were stale, so the values of these indexes did not decline as much as they might have otherwise (SEC Report 1988, p. 2-13). By contrast, the futures market opened on time with heavy selling. With stale quotes in the cash market and declining prices in the futures market, a gap was created between the value of stock indexes in the cash market and in the futures market (Chicago Mercantile Exchange, Committee of Inquiry 1987, pp. 18-29). Index arbitrage traders reportedly sought to take advantage of this gap by entering sell-at-market orders on the NYSE. When stocks finally opened, prices gapped down and the index arbitragers discovered they had sold stocks considerably below what they had been expecting and tried to cover themselves by buying in the futures market. This activity precipitated a temporary rebound in prices, visible in Figure 2, but added to the confusion (Brady Report 1988, p. 30).

As stocks opened notably lower, portfolio insurers' models prompted them to resume sales. These institutions sold in both the cash and futures markets rather than just in the futures market as was typically the practice (SEC Report 1988, pp. 2-15—2-16). Sales by these and other institutions overwhelmed the rally. Significant selling continued throughout the remainder of the day

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sell orders on behalf of customers on Monday morning and tried to pre-empt these sales.

[11] NYSE regulations allowed specialists to delay opening the stock for trading or suspend trading during the day with the permission of a floor official if the specialist believed that amount of buying or selling needed to resolve an order imbalance exceeded his obligation to provide an orderly market.

with equity prices declining steeply during the last hour and a half of trading. The Dow Jones Industrial Average, S&P 500, and Wilshire 5000 declined between 18 and 23 percent on the day amid deteriorating trading conditions (Brady Report 1988, Study III, p. 21). The S&P 500 futures contract declined 29 percent (SEC Report 1988, p. 2-12).

In comments following a speech, the SEC Chairman reportedly said that "there is some point, and I don't know what point that is, that I would be interested in talking to the New York Stock Exchange about a temporary, very temporary, halt in trading" (Wall Street Journal 1987f). This news broke shortly after 1:00 and started rumors in futures exchanges that the NYSE would be closed, prompting further sales as traders reportedly worried that a market close would lock them into their existing positions (Wall Street Journal 1987f).[12]

The record trading volume on Oct. 19 overwhelmed many systems. On the NYSE, for example, trade executions were reported more than an hour late, which reportedly caused confusion among traders. Investors did not know whether limit orders had been executed or whether new limits needed to be set (Brady Report 1988, Study III, p. 21).

Selling on Monday was reportedly highly concentrated. The top ten sellers accounted for 50 percent of non-market-maker volume in the futures market (Brady Report 1988, p. 36); many of these institutions were providers of portfolio insurance. One large institution started selling large blocks of stock around 10:00 in the morning and sold thirteen installments of just under $100 million each for a total of $1.1 billion during the day.

Many of the NYSE specialists reportedly tried to lean against the wind and support their stocks (though others apparently did not). The SEC reported that many specialists were heavy buyers early on Monday (SEC Report 1988, p. 4-9). However, as prices fell and the position of many specialists deteriorated, they started to lose the ability to continue to defend the stocks they

[12]In later Congressional testimony, the SEC Chairman stated that he had been misinterpreted. Chairman Ruder reported that in his comments he had noted that he had been in contact with the president of the NYSE prior to his speech and responded to a question regarding how one could respond to a volatile market, with a previously used statement that "Well, one of the things one might do is to have a temporary trading halt, a very, very temporary trading halt" (Ruder 1987, p. 69). The Chairman indicated that his statements about being in contact with the president of the NYSE and about a possible trading halt had not been linked in his comments but were in the press report.

were assigned (Brady Report 1988, Study VI, p. 42).

2.3 Tuesday, October 20, 1987

Before the opening of financial markets on Tuesday, the Federal Reserve issued a short statement that said:

> The Federal Reserve, consistent with its responsibilities as the Nation's central bank, affirmed today its readiness to serve as a source of liquidity to support the economic and financial system.

This statement reportedly contributed significantly toward supporting market sentiment (Murray 1987b). Perhaps spurred by this event, and despite precipitous declines in foreign stock markets overnight, the NYSE rebounded at the open (Brady Report 1988, p. 36-40).

Still, trading on Tuesday continued to be significantly impaired. Over the course of the day, about seven percent of stocks, including some of the most active, reportedly were closed for trading by the specialists as order imbalances made maintaining orderly markets difficult (Brady Report 1988, p. 45). Prior to the start of trading, the NYSE moved to prevent index arbitrage program traders from using the DOT system to execute trades, which may have affected the depth of the market.

Before it opens, the CME clearinghouse collects margin payments from members to cover losses that occurred the previous day on their open positions. (Margins will be discussed in some detail below.) Margin payments are then made to members for open positions in which the value improved the previous day. Typically these payments are completed by noon. On October 20, two CME clearinghouse members had not received margin payments due to them by noon, which started rumors about the solvency of the CME and its ability to make these payments. These rumors proved unfounded but nevertheless reportedly deterred some investors from trading on the CME (Brady Report 1988, p. 40). Bid-ask spreads widened, and trading was characterized as disorderly (Brady Report Study VI, pp. 64-65).

The typical program trading patterns were broken up. Portfolio insurers were active sellers in the futures market and pushed down prices there. Usually, index arbitragers would use this as an opportunity to buy in the futures market and sell in the cash market, which would mitigate pressure in the futures market. However, index arbitrage traders were not active, due, in part, to the NYSE's restrictions regarding use of the DOT system. This unusual pattern served to partly decouple prices in the futures and cash markets (Brady Report 1988, Study III, pp. 22-26).

With the number of trading halts for individual stocks on the NYSE and the possibility that the exchange might close, trading of many stock-index derivative products was suspended on the Chicago Board Options Exchange (CBOE) at 11:45 am and on the CME at 12:15 pm (SEC Report 1988, pp. 2-20—2-21).[13] These closures completed the de-linkage between the futures and cash markets and stocks on the NYSE began to rebound. The rise in the market was attributed in part to the removal of a "billboard," effect as the futures quotes had continually suggested that futures market participants expected the cash market to decline, and to a further reduction in selling associated with portfolio insurance (Brady Report 1988, p. 40; SEC Report 1988, p. 2-24). However, the stock market declined again once the futures markets re-opened just after 1:00 pm.

Later in the afternoon, there was a sustained rise in financial markets as corporations announced stock buyback programs to support demand for their stocks (Brady Report 1988, p. 41). Corporations had started announcing these programs Monday afternoon, but it was not until partway through Tuesday that a critical mass had formed.

[13]The SEC reports that the NYSE informed the commission that it was considering closing the exchange (SEC Report 1988, p. 2-20). CME Executive Committee Chairman Melamed also recalls that NYSE officials indicated to him that they might close the NYSE (Melamed and Tamakin 1996, Chapter 31).