Causes of Changing Financial Market Volatility

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Financial market prices, prices of stocks, bonds, foreign exchange, and other investment assets, have shown striking changes in volatility through time. For each of these kinds of assets there are years when prices show enormous unpredictable movements from day to day or month to month, and there are years of stable, uneventful markets. Why does volatility change from year to year, and what (if anything) should be done about it by government regulators and self-regulatory organizations? The striking increase in stock market volatility since around the time of the stock market crash, October 19, 1987, makes these questions seem especially relevant now. Many people in the investing public are upset about the increased volatility, and are writing letters to congressmen, agency heads, and industry leaders to do something.

The problem for those who formulate policy is that very little is known about the causes of changes in volatility of financial prices. This paper tries'to state what we know concretely about causes of changes in financial market volatility, discusses some of my own research on causes of the stock market crash of 1987, and presents a view of volatility in financial markets that is relevant to policy decisions to deal with the volatility.

Changes in volatility through time

The stock market

The current episode of stock market volatility is hardly unique.

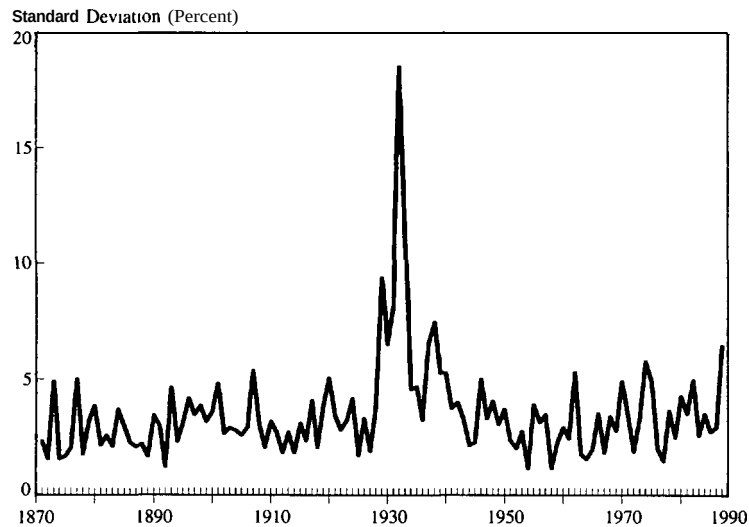
There have been repeated episodes of high stock market volatility throughout stock market history.

The stock market drop on October 19, 1987 was the biggest one-day price change ever in percentage terms. The Dow Jones Industrial Average fell 22.6 percent in one day. The drop was almost twice as big as the next biggest one-day drop, on October 28, 1929. However, the overall pattern of volatility in 1987 and 1988 is not so unique in history.[1]

Chart 1 shows the changing volatility of stock prices, as measured by the standard deviation of percentage changes in the nominal Standard and Poor Composite Stock Price Index, from 1871 to 1987.

Chart 1

Volatility of Stock Market Prices, 1871–1987



Notes: For each year, the standard deviation of month to month percentage changes is shown for the Standard and Poor Composite Index. The estimated standard deviation is based on twelve monthly observations for each year. See Appendix for source of data.

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1 Note that the *two-day* drop, October 28-29, 1929, is still the biggest two-day drop (as measured by the Dow Jones Industrial Average) in history. The biggest month-to-month percentage change in the monthly Standard and Poor Composite Index was between July and August of 1932, when the index increased 50.3 percent. This price increase, which is almost twice as big in absolute value as the biggest month-to-month price drop ever, seems to be largely forgotten. The concentration of attention on 1987 as a unique year in stock market history is to some extent an artifact of the one-day interval chosen.

The figure shown for each year is the standard deviation (estimated from 12 observations) of the 12 monthly stock price changes for the year.[2] Note that the volatility of stock price changes was higher in the years 1929 through 1933 and 1937 and 1938 than it was in 1987. Note also that there were many other years in which volatility was almost as high as in 1987. The tendency for discussion of volatility to single out the record-breaking one-day stock market drop on October 19, 1987 obscures the real dimensions of volatility over all the year.

Other speculative markets

As shown in Chart 2, other speculative markets show substantial changes in volatility through time, and these changes are largely unrelated to the changes in stock price volatility.

An index of raw industrial commodity prices shows very high volatility at the beginning of the sample, low volatility through most of the 1950s and 1960s, and higher volatility in the late 1970s and 1980s. This overall pattern does not match up well at all with the pattern of volatility of stock prices.

The dollar-pound exchange rate was very stable in the period of fixed exchange rates, except for a couple of large movements at times of devaluations of the pound (from $4.03 to $2.80 in 1949 and from $2.80 to $2.40 in 1967). If one takes account of the devaluations, there is not any striking change in overall volatility over the sample. There has been a gradual uptrend in volatility since the period of floating rates began in 1971, with short-run variations that do not correspond to those in stock prices.

Long-term bond yields were extremely variable around the time of the Federal Reserve's new operating procedures, instituted in 1979 and abandoned around 1982. This period of high volatility does not correspond to periods of really high volatility in stock prices or exchange rates, though commodity prices did show high volatility then.

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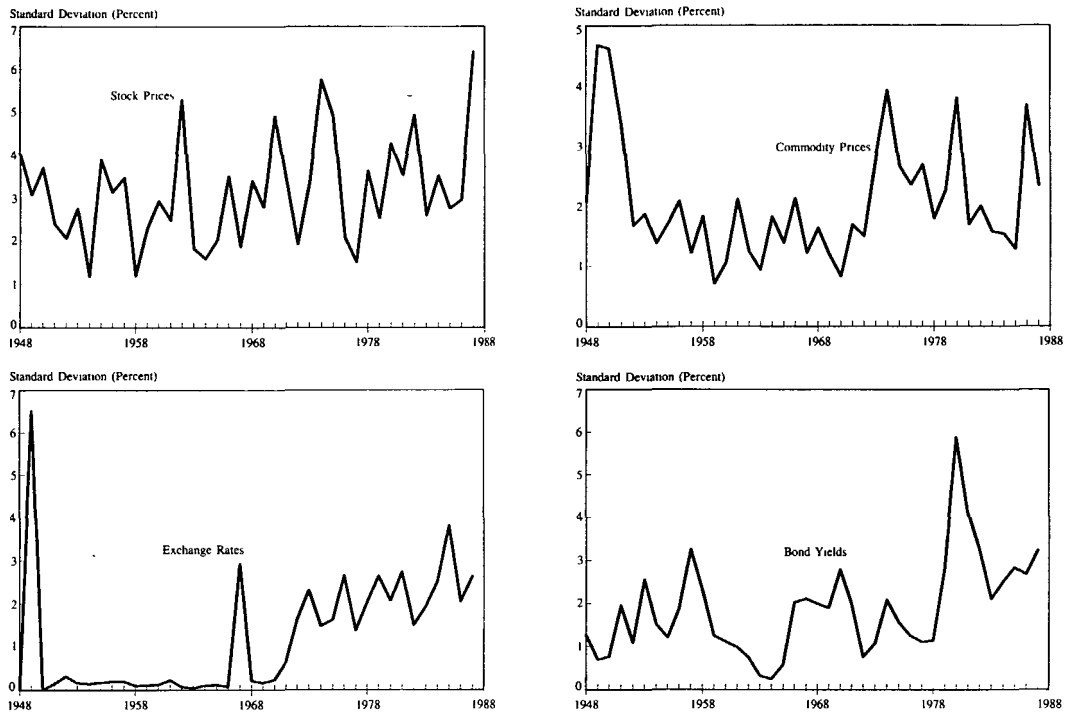
2 Data starting 1918 are monthly averages of daily closing prices; before 1918 are averages across stocks of midpoint and high and low price for each stock. The standard deviations shown are therefore downward biased measures of the standard deviation of the point-to-point price change. For a Wiener process, the standard deviation of the unit interval change in the unit average is 0.816 (the square root of ⅔) times the standard deviation of the unit interval change in the Wiener process.

Chart 2

Volatility in Various Speculative Markets, 1948–1987



Notes: For each year, the standard deviation of month to month percentage changes is shown for the following data series: stock prices (as in Chart 1), commodity prices (raw industrials), exchange rate (US/UK), and long-term bond yields (Moody's Aaa). The estimated standard deviation is based on twelve monthly observations for each year. See Appendix for source of data.

Background economic variables

It would be natural to expect that the changes in volatility through time in speculative markets would correspond to changes in volatility in real nonfinancial variables. Efficient markets theory would lead us to suspect this, since the theory says that prices in speculative markets are driven by fundamentals. But even other theories, let us say psychological theories, would tend to suggest that there is a relation between volatility in speculative markets and volatility of other macroeconomic variables.

G. William Schwert (1987) has done a time series analysis of the volatility of U.S. stock prices 1859-1986 and compared this volatility through time with other macroeconomic variables.[3] He concluded that stock volatility is not "closely related to the volatility of other economic variables," and referred to this conclusion as a "puzzle." He found that the volatility of inflation, money growth, industrial production and business failures is high during war periods, yet the volatility of stock returns is not particularly high during those periods. He pointed out that "there were many 'financial crises' or 'bank panics' during the 19th century in the U.S. that seem to be associated with very high and volatile short-term interest rates, yet there is no obvious effect on the level of stock price volatility."[4]

Standard deviations of percentage changes in industrial production, short-term interest rates, the price level and housing starts are plotted in Chart **3.** The patterns of changing volatility show little relation to the pattern of volatility in the speculative markets, except for the fact that there is some correspondence between the volatilities of short-term interest rates and long-term interest rates.[5]

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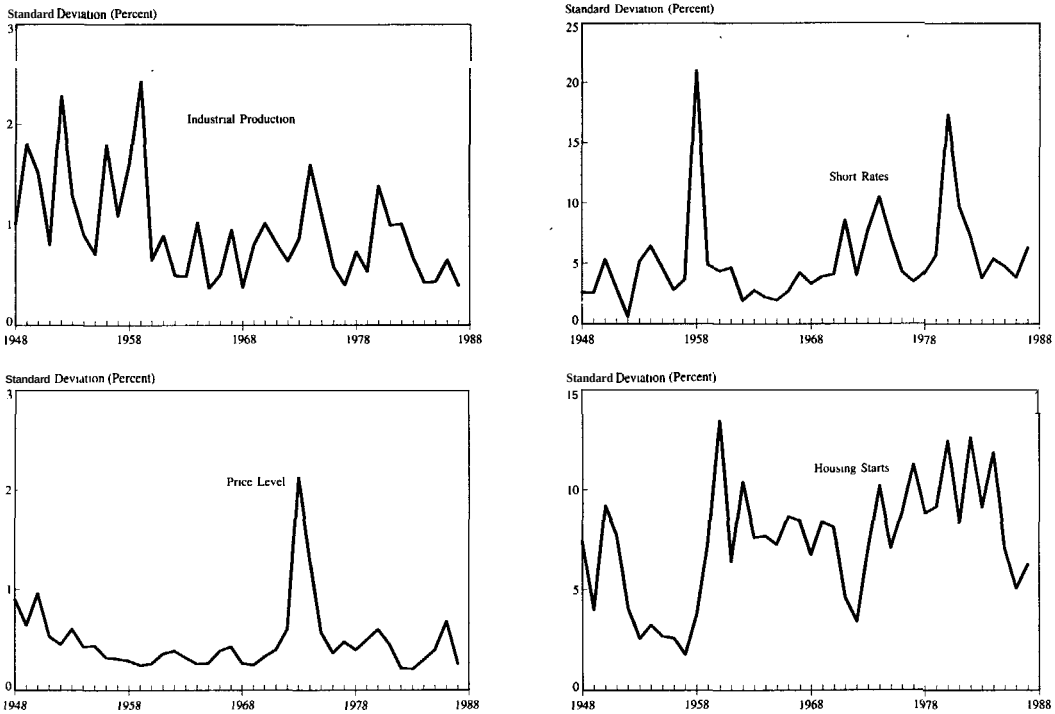
3 See also Officer (1973).

4 Schwert (1987), p. 27. Shapiro (1989) noted the lack of change in volatility between pre- and post-depression samples, and inferred that the volatility of the aggregate economy must not have changed.

5 The sharp spike in the volatility of the inflation rate in 1974 is due to the dismantling of price controls in early 1974, as well as an oil price shock then. The sharp spike in the volatility of short-term interest rates in 1958 is due to the fact that short rates dropped precipitously in the recession to very low levels: 1.50 percent in July. Then an increase to 1.96 percent in August marked a 31 percent increase in interest rates in one month.

Chart 3

Volatility of Background Economic Variables, 1948–1987



Notes: For each year, the standard deviation of month to month percentage changes is shown for the following data series: industrial production, short term interest rates (commercial paper), price level (PPI), and housing starts. The estimated standard deviation is based on twelve monthly observations for each year. See Appendix for source of data.

Interpretation

Two striking facts emerge from the plots. First, volatility seems to change dramatically through time for typical financial and macroeconomic variables. Second, there seem to be as many patterns of volatility changes as there are variables explored here.

Volatility shows no reliable uptrend through time. It is true that for all four speculative markets represented in Chart 2, volatility is higher in 1987 than it was on average over 1952-87. (The standard deviations in Chart 2 were 104 percent higher for stocks, 24 percent higher for commodities, 129 percent higher for the exchange rate, and 66 percent higher for bonds.) But there has been so much year-to-year noise that this does not signal an uptrend. The background economic variables did not show high volatility in 1987.

Proposals to deal with high volatility

Volatility in speculative markets seems to be viewed by the public as a legitimate concern of government regulators, and so any increase in volatility in markets tends to be accompanied by public demands on regulators. Thus, the increased volatility of exchange rates after the freeing of the dollar generated proposals to return to fixed exchange rates, and the increase in volatility in interest rates following the 1979 new operating procedures of the Federal Reserve produced demands that they stabilize interest rates. However, at the present time, with the vivid event of the stock market crash of 1987 on everyone's minds, most reform proposals concern the stock market, and I will concentrate attention on it here.

Influential proposals

Two proposals have been the centerpiece of recent discussion: trading halts and increased margin requirements on futures contracts. Neither of these proposals is likely to have a big effect on volatility.

Trading halts. The Brady Commission (1988) proposal most relevant to reducing volatility was its proposed "circuit breakers" that could stop trading in crisis times. The Reagan-appointed Working Group (1988) also approved such trading halts, but on a limited basis. All that group proposed relevant to volatility reduction was a one-

hour trading halt after a big market drop, 250 or 400 points on the Dow. These trading halts would hardly ever be invoked; the crash, itself, last October would be the only time in history that these halts would have been triggered.

Margins on futures contracts. It has long been noted that the advent of futures markets in effect provided a loophole around the margin requirements imposed by the 1934 Securities Exchange Act, and many people would like to see the margins on futures regulated by a government agency and, presumably, increased. David Ruder, Securities and Exchange Commission commissioner, was the dissenting member of the Working Group who wished to see margin requirements raised on stock index futures. But he is proposing only modest increases in margin requirements, to the 20 to 25 percent range. The Intermarket Coordination Act of 1988 introduced by Senator William Proxmire sets up an agency that would manage such margin requirement changes. Another proposed bill, the Securities Futures Market Credit Protection Act, would have the Federal Reserve impose margin requirements on stock index futures and options. Although neither the Brady Commission nor the bills in Congress explicitly calls for higher margin requirements on futures contracts, but rather the coordination of margin requirements across markets; arguments for the proposals make sense only if the intention is to raise margin requirements on futures contracts.

More radical proposals

Active use of margin requirements to stabilize markets has also been proposed. David Ruder, in his March 31 testimony before the Senate Banking Committee, said that "the Commission stated that the costs or benefits of more limited margin changes—such as increasing initial margin requirements in times of extreme downward price volatility for futures sales only—could be considered."[6] This is a very radical proposal, in that it would put the SEC or other agency in the business of actively stabilizing the stock market.

There are other proposals to deal with the large volatility in stock markets. The most radical of these is the abolition of futures markets

6 Ruder (1988), p. 22.

altogether. Donald Regan strongly made this proposal to the Senate Banking Committee May 11, 1988. Others are seen as supporting such a proposal. Louis Lowenstein, professor of law at Columbia University, said, "Futures markets are worse than useless. They distort the process by which capital markets are supposed to allocate resources to their most productive uses. They divert attention from the business fundamentals that are the market's proper concern."[7] James Tobin said (earlier) of such futures contracts, "The country cannot afford all the markets that enthusiasts may dream up."[8] The abolition of futures markets is probably not a viable proposal, as closing down a major industry is unlikely to be achieved for such a dubious benefit.

Rather than abolish futures markets, one might try to cut these markets off from the cash markets by abolishing the arbitrage between the two markets. The "collar" imposed by the New York Stock Exchange, which closes down the DOT system for index arbitrage when the market makes a 50-point move, is a step in this direction. A number of major firms have dropped index arbitrage at customer insistence. Proposals to inhibit index arbitrage are inherently weak. It may be possible to make index arbitrage more difficult, and so the prices on the futures and cash market may be less closely linked, but there will undoubtedly be someone who will try to arbitrage the markets so long as markets are free.

Portfolio insurance was blamed by the Brady Commission as an important contributor to the crash. Portfolio insurance is too ill-defined a scheme to be effectively abolished. If one tried to do it, it might only be driven underground, so to speak.[9] Portfolio insurance is only a formalization of stop-loss behaviors already in evidence long ago. Portfolio insurance is a sort of fad that increased stop-loss behavior. But stop-loss behavior is in the mind of traders, and not something that can be regulated so long as people are 'not barred from selling.

Other proposals are to discourage big investors from trading. The Brady Commission emphasized that the crash was caused by a few

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7 Lowenstein (1988), p. 11.

8 J. Tobin (1984), p. 10.

9 Of course, portfolio insurance has shown signs of drying up on its own in the aftermath of the crash.

big investors. Following up on this, Roberta S. Karmel, partner of Kelley, Drye and Warren, in a New York *Times* Op-Ed piece May 18, 1988, blaming the big traders, proposed declaring index arbitrage and portfolio insurance imprudent investment strategies, or taxing short-term profits of tax-exempt, institutions.

The nature of the evidence that the proposals might help

There is a remarkable dearth of solid research about the effectiveness of these proposals to reduce the large stock market volatility we have seen lately. All the proposed measures seem to have going for them is a rough sort of intuitive plausibility. For all we know, adopting them might even increase, not decrease, volatility, or reduce economic efficiency rather than enhance it.

The problem in evaluating these proposals is most importantly the absence of an agreed-upon theory of financial fluctuations. Lacking this and recognizing that any controlled experiment would likely take centuries to provide reliable evidence—we cannot know the effects of the proposals on stock market volatility.

What can we say objectively about these proposals? How can we evaluate, for example, whether margin requirements are effective? One way that has been used in the literature is to regress volatility of stock prices on the level of margin requirements. Such regressions explaining stock price volatility are of some possible value, but will not resolve whether extending high margin requirements to futures contracts will now reduce the volatility. The margin requirement changes may have been in response to changes in other variables, or otherwise correlated with them. Hardouvelis (1988), who has undertaken a careful study by regression methods using U.S. data since 1931, claims to have found that margin requirements help reduce volatility.[10] He attempted to correct for the reverse causation possibil-

10 Official margin requirements were, of course, zero in the part of his sample from 1931 through most of 1934, before the 1934 Securities Exchange Act took effect, and volatility in the stock market was extremely high then. Thus, he finds a spurious "effect" of margin requirements on volatility, when in fact, causality runs from volatility to margin requirements. When he truncates his sample to start in 1935, he finds margin requirements are just barely significant at the 5 percent level. His significance levels are perhaps unreliable, since he corrects for only the 12-month moving average induced autocorrelation of residuals, not the apparent year-to-year autocorrelation that extends further.