Circuit Breakers and Program Trading Limits:

What Have We Learned?

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Abstract

Exchanges adopted several circuit breakers and program trading limits following the 1987 Stock Market Crash. The intended purpose of these policies was to reduce volatility. Unfortunately, there has not been enough extreme volatility to conclusively determine whether they have been effective. The lack of volatility does not demonstrate their effectiveness since extreme volatility is very rare. Theoretical studies are also inconclusive. Some suggest that circuit breakers help prevent crashes by giving people time to respond with full information. Others suggest that they accelerate price changes caused by traders afraid they may not be able to trade. Some simple principles from political economy suggest why exchanges adopted the circuit breakers that they did.

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1. Introduction

In the ten years since the October 1987 Stock Market Crash, questions about whether the market is (or should be) adequately protected by circuit breakers have often been raised and addressed. Unfortunately—and fortunately!—no satisfactory answers to these questions have emerged.

Our ignorance is unfortunate because circuit breakers can have very significant effects upon markets. Whether these effects are good or bad is debatable. We clearly need to know more about these effects if we are to make good decisions about whether to apply circuit breakers to our markets, and if so, which ones.

Our ignorance is fortunate because we learn the most about circuit breakers when prices are extremely volatile. Without extreme volatility, it is almost impossible to determine what effects circuit breakers have on the markets. Since most people do not like extreme volatility, we have been fortunate not to have had more opportunities to learn more about circuit breakers. Unfortunately and fortunately, we may not obtain good answers to most important questions about circuit breakers in our lifetimes.

This paper surveys what we know about circuit breakers. We start with a quick review of some concepts necessary to understand what circuit breakers do. Then we describe the circuit breakers adopted since the crash and quickly review the various arguments for and against them. Next we discuss the difficulties associated with empirical research on these topics and review the work done to date. Finally, we conclude by speculating about why U.S. markets adopted the circuit breakers that they did.

Four concepts of power appear in our discussions: Economic power, psychological power, political power, and statistical power. Circuit breakers have economic power since they restrict what traders do and because they alter relationships among various classes of traders. Circuit breakers have psychological power because they can change how people think about trading and security values. Issues involving political power arise when we consider which circuit

breakers markets will adopt. Finally, analyses of statistical power explain why empirical studies that attempt to examine the effects of circuit breakers cannot be convincing.

2. Introductory Concepts

All circuit breakers limit trading activity in some way. **Trading halts** stop trading when prices have moved, or will imminently move, by some prespecified amount. Trading resumes after some time interval. **Price limits** require all trade prices to be within a certain range. If traders are unwilling to negotiate prices within the limited range, trading will stop. Trading can resume anytime traders are willing to negotiate prices within the price limits. **Transaction taxes** restrict trading by taxing it. **Margin requirements** and **position limits** restrict the size of positions that traders can accumulate. **Collars** restrict access to computerized order submission systems.

Proponents of circuit breakers generally hope that these restrictions will decrease volatility. To evaluate whether they do or not, and to consider whether they are desirable, we must discriminate among various volatility concepts.

Economists identify and differentiate among two types of volatility: fundamental volatility and transitory volatility. Fundamental volatility relates to uncertainty about underlying security values. The trading process causes transitory volatility.

Stock prices generally reflect the fundamental value of a firm's uncertain prospects. When they do not, informed traders—traders who can estimate security values well—will trade. Informed traders buy when they think that security prices are too low, and they sell when they think security prices are too high. Their trading tends to push prices toward their estimates of value. When traders discover new information about fundamental values, prices therefore adjust to reflect the information. Economists call this type of volatility **fundamental volatility**.

Although traders may not like fundamental volatility, economists generally believe that it is good for the economy. Stock prices that accurately reflect all information about firms' prospects are essential for allocating resources in our free market economy. We use security prices to allocate capital to new ideas, and to allocate managers to existing capital. When prices do not accurately reflect security values, we make these decisions poorly, and inefficient production results. Circuit breakers that cause prices to adjust slowly to new information impose costs on the economy.

Transitory volatility results when uninformed buyers and sellers want to trade at different times. Buyers tend to push prices up and sellers tend to push prices down when they do not arrive at the market at the same time. In a market that is very liquid, buyers and sellers can easily arrange their trades without much effect upon prices. Liquid markets, therefore, have little transitory volatility.

The identifying characteristic of transitory volatility is that it results from transitory price changes. When uninformed traders push prices away from their fundamental values, informed traders ultimately trade and push prices back. Transitory volatility is the tendency of prices to bounce around their fundamental values.

Transitory volatility is undesirable because it causes price changes that are unrelated to fundamental value. Circuit breaker proponents hope that circuit breakers will decrease transitory volatility.

3. Post Crash Circuit Breakers

3.1 Trading Halts and Price Limits

One year following the 1987 Crash, the New York Stock Exchange, American Stock Exchange, the National Association of Securities Dealers, and various regional exchanges all adopted some trading halt rules.[1] As originally implemented, these rules would have halted trading for one hour if the Dow Jones Industrial Average fell by 250 points. If the Dow fell an additional 150 points after trading resumed, the markets would have halted trading for two more hours. These halts were never triggered. When they were implemented in 1988, a 250 point move in the Dow would have been approximately 12 percent. With the rise in the market since then, by early 1997, a 250 point would have represented only a four percent move. On March 8, 1996, a 217 point intraday drop in the Dow almost triggered a halt. Partly in response to this close call, the exchanges changed these rules in July 1996 and February 1997. The revised rules now halt trading for one-half hour if the Dow drops 350 points and for an additional one hour if it drops 200 points more. These halts were triggered for the first time on October 27, 1997 when the Dow fell 350 points by 2:35 p.m. In the 25 minutes following the reopening at 3:05 p.m., the Dow fell an additional 200 points to trigger a second halt which closed the markets for the day.

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[1] The NYSE rule is known as Rule 80B.

On December 4, the NYSE Board approved some changes to these circuit breakers. If approved by accepted by the SEC, after 2 p.m., the 550-point circuit breaker would halt trading for 30 minutes instead of 60 minutes. Trading would not resume if the halt was triggered after 3 p.m., however. After 3:00 p.m., the 350-point circuit breaker would be removed.[2]

The Chicago Mercantile Exchange also adopted several price limit rules for their S&P 500 contract following the Crash. In October 1989, these rules included a price limit if the futures contract dropped 12 points from its previous day's close. The limit would be effective for the earlier of 30 minutes or 2:30 Chicago time. A second price limit was set at 30 points down. This limit would be effective for one hour if the Dow had not fallen by 250 points. Otherwise, the Exchange would halt all trading for one hour and restart it only when at least 50 percent of the S&P stocks are trading. Finally, the Exchange imposed a maximum daily limit of 50 points up or down with a two-hour trading halt if the Dow had fallen 400 points. The October 13, 1989 "Mini Crash" triggered the first and second of these price limits.

3.2 Collars

In July 1990, the New York Stock Exchange implemented two collars through amendments to its Rule 80A. The first collar prohibits traders from submitting market orders through the SuperDot order routing system when doing index arbitrage program trades if the Dow has moved by more than 50 points from its previous day's close. Instead, index arbitrage traders must submit limit orders or tick sensitive orders. With a tick sensitive order, a trader can only buy on a down or zero-down tick, and can only sell on an up or a zero-up tick. This provision of Rule 80A remains in place until the market has returned to within 25 points of its previous day's close. The NYSE presently is

The second collar of Rule 80A is the sidecar. The Exchange makes the sidecar active in the first five minutes after the S&P 500 futures contract drops more than 12 points (about 96 Dow points) from the previous close. When made active, the SuperDot order routing system diverts all program trading market orders for S&P 500 stocks into a file. At the end of the five minutes, the Exchange pairs off buy and sell orders and submits any remaining order imbalance to

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[2] The NYSE is likely to propose additional changes in 1998. They have discussed widening the limits to approximately 10 percent and 20 percent. The exact bounds would be expressed in points and adjusted annually in December.

the floor. If the floor cannot handle the imbalance in an orderly fashion, the Exchange halts trading in the stock and disseminates information about the order imbalance to the public. The rule also prohibits the submission of new stop orders in all stocks for the rest of the day, unless they are submitted by individuals for less than 2,100 shares. The sidecar can be made active only once a day.

As the Dow has risen over the years, price changes have triggered these collars quite frequently. In the first eight months of 1997, the 50 point collar was triggered on 83 percent of the trading days.

3.3 Increased Margin Requirements and Transaction Taxes

Although there were numerous calls for increased margin requirements and securities transaction taxes following the Crash, no such changes were made.

4. The Economics of Circuit Breakers

Many authors have discussed the economics of circuit breakers and the arguments for and against them. This section summarizes many of their arguments, and identifies the more important theoretical analyses.[3]

4.1 Trading Halts and Price Limits

Trading halts (and price limits) can reduce short-term volatility by slowing price changes. Whether this is desirable, however, depends on the cause of the volatility.

If new fundamental information causes the volatility, the halt will merely postpone the inevitable. While the markets are closed, prices will be less informative and no one will be certain of the new level. Worse, the uncertainty associated with the halt may cause uninformed traders to panic, which may generate unnecessary transitory volatility when the market reopens. On the other hand, if uninformed traders panic when price is moving quickly, the trading halt may cut them off before they can act.

If an order imbalance originating among uninformed traders causes the volatility, a trading halt that stops their trading may be beneficial. The benefits come from protecting the market from

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[3] Kyle (1988), Harris (1989) and Moser (1990) provide three especially useful discussions. Kyle's discussion is noteworthy for its breadth. Moser's discussion is noteworthy for his classification of circuit breakers by their triggering mechanism: order-induced, volume-induced, and price-induced.

their volatility-inducing trades and from protecting them from trading losses that they will likely incur in poorly functioning markets.[4]

Such halts may also give informed traders an opportunity to enter and provide liquidity. Greenwald and Stein (1991) and Kodres and O'Brien (1994) provide theoretical models that address the latter possibility. Both papers show that when uniformed trades cause prices to move quickly, informed value-motivated traders may become uncertain about the prices at which their orders will execute. If so, they tend to withdraw to avoid this "transactional risk." Circuit breakers improve market performance in these models by allowing traders to be better informed before trading.

A trading halt rule may also decrease transitory volatility if the halt allows traders greater time to respond to intraday margin calls and/or to remove stop-loss orders. When traders are unable to satisfy their margin calls, brokers will trade to stop their losses. Since stop-loss orders further imbalance an uninformed order flow, a halt that reduces their numbers may reduce transitory volatility.

In an order-driven market that arranges trades by matching incoming orders with standing limit orders, a trading halt rule may make the market more liquid. In such markets, liquidity comes from the traders who offer standing limit orders. Trading halts favor these traders by switching the trading mechanism from a continuous auction to a single price auction when the market reopens. In the continuous auction, standing limit orders typically trade at their limit prices. When price is dropping quickly, traders who use limit orders to buy stock suffer immediate losses when their orders execute as price continues to fall. In a single price auction, all orders trade at the same market clearing price. If there is a large sell order imbalance, the clearing price will be low, and all limit order buyers will receive it. Limit order traders therefore benefit from the trading halt rule. When protected by such a rule, these traders may be more willing to offer liquidity under normal circumstances. The trading halt rule therefore can decrease transitory volatility by encouraging traders to offer more liquidity.

Two arguments suggest that trading halts and price limits may increase transitory volatility. First, if traders fear that a halt will occur before they can submit their orders, they may

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[4] Kyle (1989) argues that an exchange may want to impose trading halts that protect uninformed traders to safeguard its reputation.

submit them earlier than otherwise to increase the probability that they execute. Greater volatility will therefore result as the triggering price attracts orders from rationally fearful traders. Authors sometimes call this effect the gravitational effect or the magnetic effect. Subrahmanyam (1994) provides a theoretical model that illustrates this effect. Subrahmanyam (1995) suggests that a discretionary rule halt procedure may dominate a rule-based trade halt procedure because the latter is less predictable.

Second, informed traders may reduce their surveillance of the market if they know that they will be notified when a trading halt occurs. If so, the trading halt rule will make the market less liquid between trading halts. Transitory volatility will increase and there will be more trading halts. No study of which I am aware has addressed this issue.[5]

When two markets trade essentially the same risk, the imposition of a trading halt or a price limit on one market will have profound consequences on the other market. In particular, when only one market halts trading, traders will divert order flow to the other market. It seems reasonable that if circuit breakers are desirable, exchanges should coordinate their regulations. Morris (1990) argues that uncoordinated circuit breakers may increase volatility by preventing excess demands for liquidity to be met in two markets instead of one.

Trading halts and price limit rules also benefit the markets by making it easier for brokers and clearing houses to collect margins. Brennan (1986) shows that these rules function as a partial substitute for margin requirements if traders are uncertain about ultimate equilibrium values during trading halts. An example illustrates why: Suppose that a trader who has posted a 10 percent margin will go bankrupt if price drops by 25 percent. If price immediately drops 25 percent, the trader should lose everything. In practice, he will lose his margin and, at potentially great expense, the broker may collect an additional 15 percent. If instead the Exchange limits the price drop to five percent per day, and if the trader does not realize that the total drop will ultimately be 25 percent, then the trader may voluntarily meet one or more five percent margin

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[5] In the Greenwald and Stein (1991) model, the number of value-motivated traders who respond to a volume shock of uninformed traders is random and exogenous. They attribute the random response in part to uncertainty about the number of traders who are monitoring the market. This uncertainty contributes to the transactional uncertainty that causes these traders to withdraw from the market when uninformed traders cause prices to change quickly. Although they conclude that circuit breakers can help these value-motivated traders better understand what is going on, and thereby improve market quality, they do not model the effect of a circuit breaker on the distribution of the number of value-motivated traders who initially respond to volume shocks.

calls. Since these voluntary payments are easier to collect, brokers can require lower margins when protected by price limit or trade halt rules than they would otherwise.

4.2 Collars

The primary effect of the Rule 80A collars on program trading is to make arbitrage more difficult and expensive when the collars are active. They most likely increase transitory volatility because they force the cash and futures markets to operate more independently. When arbitrage is unrestricted, arbitrageurs move liquidity from the market where it is in greatest demand to the market where it is in greatest supply. Their efforts reduce transitory volatility because order flow imbalances in the two markets sometimes cancel. When the collar restricts arbitrage, each market must separately satisfy demands for liquidity. These collars make it more difficult for arbitrageurs to cross a buy order placed in one market with a sell order placed in the other market.[6]

In practice, index arbitrageurs can subvert the collars two ways. They can submit their program trades through floor brokers, and they can submit fewer than 15 orders through SuperDot to avoid classification as a program trade. Both methods increase arbitrage costs and risks, but not appreciably so. The collars therefore should not have much effect on the markets.

Proponents of these rules argue that they decrease volatility at the NYSE by preventing the cash market from being whipped around by the more volatile futures market. Although this result is undoubtedly true, the argument fails to distinguish between fundamental and transitory volatility. The futures market is more volatile than the cash market over short time intervals because it is better organized to quickly discover fundamental index value. Unlike the cash market, futures trading is unrestricted by concerns about price continuity and by the need to separately discover prices in the markets for 500 securities.

4.3 Increased Margin Requirements and Transaction Taxes

Throughout financial history, many have believed that excessive trading increases volatility. Accordingly, many commentators have proposed that greater margins and/or securities transaction taxes be placed on stocks and futures to reduce trading.

Margins and transaction taxes have related but slightly different effects on trading. The effect of a large margin is to decrease position sizes, either by increasing the costs of carrying a

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[6] Holden (1995) provides a model that develops this view of arbitrage.

position, or by preventing a capital-constrained trader from acquiring a large position. If it increases carrying cost, margins penalize a single long-term trading strategy more than a single short-term strategy. However, since most short-term traders are also high frequency traders, this difference in effects may not be important. A securities transaction tax reduces all trading by taxing it directly. It therefore tends to penalize short-term, high-frequency trading strategies relatively more than long-term, low frequency strategies.

Numerous academic studies discuss the arguments for and against margin requirements and transaction taxes.[7] This survey will introduce these arguments by considering how these circuit breakers would affect various types of traders.

Speculators—also known as **informed traders**—trade to profit from their superior ability to forecast future prices based on their access to fundamental information. Any efforts to restrict their trading will make the market less efficient.[8] Since they often offer liquidity when uninformed traders move prices away from fundamental values, any measure that reduces their incentives to trade will increase transitory volatility.

Dealers are traders who profit by offering liquidity to other traders. Any measures that increase their transaction costs will decrease market liquidity and create more transitory volatility.

Bluffers are traders who attempt to profit by tricking other traders into offering liquidity foolishly. In a typical bluffing strategy, the bluffer acquires a large position with as little impact on price as possible. The bluffer then buys very aggressively in attempt to quickly raise prices and generate excitement. Bluffers may time this part of the strategy to immediately follow the release of positive information that the bluffer hopes other traders will misinterpret when associated with the large price change that the bluffer creates. The bluffer may also generate rumors at this time, although this is generally illegal. If the bluff is successful, foolish momentum traders will jump on the bandwagon and try to buy as well. The bluffer will then sell his position to these traders at the top. Since the bluffing strategy is unrelated to fundamental information, the price changes

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[7] Arguments concerning margins appear in Moore (1966), Figlewski (1984), Hartzmark (1986), Hardouvelis (1988a and 1988b), Warshawsky (1989), Kupiec and Sharpe (1991), Ma, Kao, and Frohlich, Chance (1993), and Kupiec (1997).

Arguments concerning securities transaction taxes appear in Stiglitz (1989) and Summer and Summers (1989), Amihud and Mendelson (1990), Grundfest and Shoven (1991), Kupiec, White and Duffee (1993), Schwert and Seguin (1993), Subrahmanyam (1996), and Kupiec (1995, 1996, 1997).

[8] Subrahmanyam (1996) notes, however, that a high transaction tax may eliminate some deadweight losses to society that come from too many informed traders competing to profit from the same information.

associated with bluffing are transitory. The larger are these price changes, the more money the bluffer will make. Any measures that increase the costs of trading will discourage the bluffing strategy and potentially decrease transitory volatility.

Bluffers face two risks when attempting their strategy. First, they risk failing to fool other traders. If so, the bluffers will lose money through simple transaction costs. Of greater concern to them is the risk that a speculator will call their bluff. If the bluffer can push prices away from fundamental values, speculators who recognize the discrepancy will step in and supply liquidity to the bluffer. If the speculators have more capital than does the bluffer, the bluff will fail and the bluffer will lose much money.

Unfortunately, most regulatory measures designed to increase transaction costs for bluffers will also negatively affect speculators. The only feasible way of discriminating between the two types of traders would likely be based on their holding periods. The bluffer typically must open and close his position quickly before speculators become aware of his actions. Speculators, on the other hand, can wait before closing their positions, although they may incur substantial financing costs in the interim.

Gamblers trade for entertainment, although many may not realize it. Gamblers include all uninformed traders who trade because trading excites them. Although they often believe that they are informed traders, they usually trade on stale information, that is, information that prices already reflect. Since gamblers are uninformed traders, the price impacts of their trading contribute to transitory volatility. Measures that increase their transaction costs will decrease transitory volatility. Unfortunately, it is difficult to target these traders since most of them will claim, and may even appear, to be informed traders.

Utilitarians trade for reasons other than trading profits. Instead, they use the markets to solve various problems that originate outside the markets. **Investors** use markets to move money from the present to the future. For example, many investors move current income from the present to the future to provide for their retirements. **Borrowers** do the opposite: Many students borrow to move future income to the present so that they can pay for their tuition. **Hedgers** use markets to construct hedge positions that lower their overall exposure to various risks: A wheat farmer may sell wheat futures contracts to hedge the price risk associated with the wheat growing in his fields. **Asset exchangers** use markets to exchange an asset that is of less value to them for

an asset that is of greater value: American tourists who travel in Germany must exchange US dollars for German marks because the latter are greater value to them in Germany than the former.

Utilitarian traders use the markets because they value the services that markets provide them. Since they are uninformed traders, their trading contributes to transitory volatility. Any measures that increase their transaction costs will decrease transitory volatility. Unfortunately, and perhaps quite significantly, these measures will also harm the economy by making it harder for these traders to solve the important problems that they face.[9]

4.4 Summary

The theoretical effects of circuit breakers on volatility are mixed. We can confidently say that circuit breakers will slow price changes associated with changes in fundamental information. Their effects on transitory volatility, however, are less certain. They decrease transitory volatility when they restrain the trading of those who most contribute to it. These traders are typically uninformed traders and bluffers. On the other hand, they increase transitory volatility when they restrain the trading of those whose trading normally limits transitory volatility. These traders include informed speculators, dealers and arbitrageurs. Since we do not know which effect is larger, the net effect of circuit breakers on transitory volatility therefore appears indeterminate.

Some circuit breakers may increase transitory volatility while others decrease it. For example, the Rule 80A collars probably increase transitory volatility because they primarily restrict the trading of arbitrageurs while having almost no effect on uninformed traders. Conversely, the trading halts may decrease transitory volatility because they primarily protect liquidity suppliers while frustrating uninformed traders.

5. Empirical Analyses

Given the indeterminate theoretical predictions about how circuit breakers effect transitory volatility, empirical analyses are necessary to resolve our uncertainties. This section considers the evidence collected to date on circuit breakers. Before presenting that evidence, however, consider the statistical problems associated with making inferences about circuit breakers.

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[9] Kalavthi and Sanker (1991) provide a theoretical model which demonstrates how costly margins decrease hedger welfare.

5.1 Sources of Statistical Power

It can be very difficult—or even impossible—to reliably estimate the net effect of a circuit breaker on the markets. The difficulty lies in the myriad of alternative explanations for why prices change. For example, a decrease in transitory volatility following the imposition of the circuit breaker may be due to the imposition of the circuit breaker, or it may be due to a completely unrelated decrease in the number of uninformed traders, or perhaps the emergence of a new technology that allows traders to offer more liquidity. Without making strong assumptions about what volatility would have been had the circuit breaker not been imposed, it is impossible to make reliable inferences about the specific effects of the circuit breaker.

Consider, for example, what happened to daily volatility in the years following the imposition of circuit breakers in 1988. In the seven years from 1989 through 1996 (the last year for which CRSP data was available to me), the standard deviation of the daily S&P 500 Index return was 73 basis points. Not surprisingly, this was substantially lower than the corresponding figure of 162 basis points for 1987-88. It would be unreasonable, however, to attribute the decrease to the new circuit breakers (unless you believe that the 1987 Crash was due to a **lack** of circuit breakers)! It is more noteworthy to observe that the standard deviation for the seven years before the Crash, 1980-1986, was 90 basis points, which is significantly greater than the 73 basis points for the post-circuit breaker period. Although it is possible that the decrease was due to the circuit breakers, it is also quite likely that the high volatility in the pre-crash period was due to the uncertainty associated with the high inflation experienced over that period. When regression methods are used to control for the volatility of unexpected inflation, the before-crash and after-circuit breaker standard deviations differ by only four basis points, which is neither statistically nor economically significant.[10]

These results undoubtedly also depend on the sample period. Had I been able to include the volatile 1997 data in this analysis, the post-adoption volatility might have been greater than the pre-adoption volatility.

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[10] The series of unexpected inflation was constructed by regressing seasonally unadjusted monthly CPI inflation rates on lags 1-3 and 11-13 of its values. From the monthly series of residuals, an annual series of residual standard deviations was then constructed to proxy for inflation uncertainty. The adjusted returns to the S&P 500 Index for the two periods was computed by regressing the S&P 500 annual return on the inflation uncertainty series and dummies for the two sample periods. As expected, the regression coefficient for the inflation uncertainty was positive and statistically significant.

This example may be somewhat misleading since it examines total volatility rather than just transitory volatility. The problem of confounding explanations, however, also applies to transitory volatility. Moreover, in practice, it is very difficult to accurately decompose volatility into its transitory and fundamental components. As a consequence, fundamental volatility factors will affect the estimated transitory volatility component whenever the decomposition is not perfect. Moreover, many reasonable arguments link fundamental volatility factors to transitory volatility.[11] These problems greatly complicate statistical inferences of transitory volatility. Although the example is not perfect, it still quite usefully characterizes these statistical problems.

Given the problem of confounding explanations, and the dependence of the results on the sample period, it is clearly unreasonable to make any conclusions about the effects of the circuit breakers on volatility in this simple framework. These problems are typical of one-shot event studies.

Statisticians frequently get around the problem of confounding explanations by examining large samples. Very powerful analyses are possible when we can reasonably expect that the effects of unaccounted-for volatility factors will average to zero in a large sample. In which case, we can identify the effect, if any, of the imposition of the circuit breaker.

To consider whether this expectation is reasonable when making inferences about circuit breakers, we have to identify exactly what we mean by "large sample." A sample can be large in three ways. It may include many rule adoptions, it may include many securities affected by a single rule, or it may include many time periods affected by a single rule.

The strongest imaginable study would be the classical event study: Ideally, we would like to analyze a sample of many circuit breaker adoptions. If these adoptions occurred in many different markets at many different times, a before and after contrast would not depend much on omitted volatility factors. Unfortunately, markets have adopted few circuit breakers.

Some circuit breakers that markets have adopted apply to many securities. Although the number of potentially affected securities is large, information about the effects of these market-wide circuit breakers unfortunately does not increase much with the size of the sample. We

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[11] For example, dealers are exposed to more inventory risk when fundamental volatility is high. To avoid this risk, they may withdraw some from the market.

would only learn substantially from the cross-section if the circuit breakers applied separately to each security, and then, only insofar as security prices move independently of each other.

Finally, a sample can be large in the sense that it includes many periods. Ideally, each period would provide information about the effect of circuit breakers. Whether they do depends on how often prices trigger the circuit breaker and upon how specific are the circuit breaker's expected effects.

If the circuit breaker is very rarely tripped, we will learn little from each additional time-series observation. Although additional time-series observations improve the precision of before and after volatility comparisons, unrelated factors will likely influence this comparison. If these factors vary slowly over long periods, additional time-series observations will not be very informative.[12] This argument applies even more forcefully to increases in sample size obtained by sampling more frequently over a given interval. More frequent sampling allows us to more accurately estimate the combined effects on volatility of circuit breakers and of other volatility factors, but it does not help us to separately identify these effects.

If prices frequently trigger the circuit breaker, it may be possible to reliably identify some of its effects on the market, especially if these effects are specific to the circuit breaker. For example, some aspect of trading may change whenever Rule 80A is triggered. Studies that contrast market conditions before and after price changes trigger the rule may be quite powerful since these events are now quite common.

Although confounding explanations may influence any inference, this design greatly limits the set of reasonable alternatives. To systematically influence the results, an alternative explanation must be correlated with the triggering of the rule and also be independent of the rule. Only the unknown factors that triggered the rule obviously qualify. Fortunately, we can model any systematic effects from these factors using data obtained before the adoption of the rule. For example, suppose that transitory volatility rises following the triggering of Rule 80A. This rise may be due to the rule or to the price change that triggered the rule. To discriminate between these two explanations, we can examine volatility before and after similar sized intraday price changes in the pre-Rule 80A data. This contrast will identify the price change effect. The

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[12] Examples of such factors include all variables related to macroeconomic trends and cycles.

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difference between the total effect in the post-Rule 80A data and the estimated price change effect is the estimated effect of the Rule.[13]

It might appear that a similar argument would support the following conditional analysis: Suppose that we want to know whether the presence of a circuit breaker affects the distribution of intraday price changes that follow a price change of some given size. This conditioning price change may be greater, equal, or less than the price change that triggers the circuit breaker. A large sample of days on which the conditioning event occurred will support a powerful analysis of how the circuit breaker affected trading before and after the conditioning price change on those days. It will not, however, allow us to make strong statements about how the circuit breaker affected the subsequent intraday distributions. An analysis that contrasts these distributions before and after the adoption of the circuit breaker will be very sensitive to confounding alternative explanations. In particular, any process that causes volatility to be unconditionally higher or lower in the post-adoption period will also affect these conditional distributions.

5.2 Empirical Evidence

Trading Halts and Price Limits

Only one study of which I am aware has attempted to determine how the coordinated trading halt rules adopted by the NYSE, CME and the various regional and options exchanges affect volatility. Santoni and Liu (1993) test for changes in volatility surrounding the adoption of the circuit breakers using an ARCH model. Using data through May 1991, they find no significant effects. As noted above, since numerous other factors could affect volatility, the results are not reliable.[14]

As of this writing, the coordinated trading halts have been triggered only once. On Monday, October 27, 1997, the Dow Jones Industrial Average fell by 350 points by 2:35 p.m. All markets were then halted for 30 minutes. At 3:05 the markets reopened and proceeded to trade down an additional 200 points in the next 25 minutes to trigger the second and final halt. Prices

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[13] NYSE (1991), Kuserk, Locke and Sayers (1992), Santoni and Liu (1993), and McMillan and Overdahl (1998) use this empirical strategy.

[14] The use of the ARCH process probably does not contribute much to the results. The ARCH model allows the authors to model how variances change at high frequencies through time. Since the effect of circuit breakers on volatility should be a long-term effect, it will act at very low frequency. The ARCH technology therefore is not needed here.

dropped at an accelerating pace during these 25 minutes on increasing volume. During these 25 minutes, volume per minute averaged about twice the volume seen earlier in the day. The next day, the Dow recovered 337 points.

Although this event will be widely studied, we unfortunately cannot learn very much from it. The problem is that we do not know what would have happened had the circuit breakers not been in place.

Circuit breaker proponents argue that the halts successfully prevented the market from dropping as it did in October 1987. They assert that the halts allowed sensible traders an opportunity to buy. Had trading not been stopped, these traders might not have been able to participate. In particular, they note that corporate share repurchase activity may have been at least partly responsible for the market turnaround on Tuesday. The halts helped these traders since they probably could not act quickly on Monday.

Circuit breaker opponents argue that the halts increased volatility by scaring traders, especially after the first halt. They cite the accelerating price fall on increasing volume as evidence of trader desires to complete their trades before the next halt.[15] Had traders not been afraid of the halts, they may not have sold so aggressively and prices might not have dropped as much on Monday.

It is not obvious how to discriminate between these two interpretations of the event. Both arguments depend on differing assertions about what would have happened had the circuit breakers not been in place. Without mind-reading techniques and without reliable methods for reconstructing a false history, we will not be able to reliably discriminate among the two perspectives.[16]

The CME 12 point and 30 point price limits were triggered during the "Mini Crash" of October 13, 1989. Moser (1990) and McMillan (1991) examine their effects on that day.[17] Moser shows that the failure to coordinate the circuit breakers caused volumes to increase substantially at the NYSE. He argues that this may have exacerbated the problem. McMillan

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[15] Proponents, however, note that the high volume between the two halts may be explained simply by the collection of order flow during the first halt.

[16] Some analysts may be tempted to reconstruct history by asking what would have happened had the orders entered during the halt been processed at the time they were submitted. This would be a useful exercise if we could reasonably assume that those orders would have been entered even if there were no halt. This assumption, however, violates the premise maintained by circuit breaker opponents.

focuses primarily on the futures markets. Using a logit and error-correcting models of price changes, he finds some evidence of a gravitational effect before the price limits that were triggered on October 13, but stabilizing effects before the 12-point limit triggered on October 26 and nearly triggered on October 16. He assembles this evidence by including the distance to the price limit in these models. Unfortunately, the analyses only include three sample points[18]. The small sample and the inconsistent results suggest that all we can learn from these events is that the effects of the CME price limits are not overwhelmingly obvious.

About three times a day, the New York Stock Exchange halts trading in individual stocks. The most common reasons for these halts are order imbalances, news pending, and news dissemination. Lee, Ready and Seguin (1994) examine these halts to determine what effect they have on subsequent trading volumes and volatilities. To control for the fact that these events are usually associated with large price changes, they match trading halts with events they call "pseudo halts" – similar price episodes in the same stock for which there was no halt. Their results show that volumes were significantly higher for three days following halts than following pseudo halts. Volatility was significantly higher for only one trading day. The differences appear to increase with the degree of news coverage. They conclude that this evidence is inconsistent with the hypothesis that trading halts tend to stabilize prices.

The results, however, are subject to criticism. The authors note that despite their best efforts to fairly compare the halts with the pseudo halts, and in particular, to control for differences in information, the halts may be associated with more significant information (and information uncertainty) than the pseudo halts. If so, the inferences drawn from the contrast between the two types of events are not meaningful. Although the authors attempt to dismiss this possibility, I believe that it is likely. Price does not mechanically trigger these trading halts. Rather, various process that very likely identify significant information events trigger them. It seems likely that the differences between halts and pseudo halts reflect these differences in

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[17] See Moser (1990) and McMillan (1991).

[18] The analyses are also subject to a sample selection bias. The sample selection bias is due to skewing the sample toward days with limit moves. On a day when the price limit is triggered, we know that the probability of a price decrease in the minute prior to the triggering of the limit is one. Moreover, given that a limit move will be made, the probability that price declines in any given minute increases the closer we are to the actual limit move. Thus, the distance to the limit will be correlated with the probability of a price decrease. In particular, this bias explains why the predicted probability of a decrease, commented upon on page 269, approaches 0.9 immediately before the breaker was hit.

information more than the discontinuity in the trading process. If so, the most that these events can tell us about circuit breakers is that halts clearly do not overwhelmingly stabilize prices.

The Tel Aviv Stock Exchange (TASE), among others, imposes fixed price limits separately on all stocks. Lauterbach and Ben-Zion (1993) studied TASE trading during the week of October 19, 1987, to determine what effect the price limits had on trading. The TASE then used a single price auction to trade all stocks. (A few of the largest stocks later traded on a bilateral basis when called in a rotation.) The rules then in effect required that clearing price be within ten percent of the previous close. Otherwise trade in the stock would halt (that is, it would not trade at all). Unlike other markets, today's excess demand and supply schedules based on yesterday's closing price are publicly known before the single price auction. If there is a limit price move, these schedules are also known at the limit price. Lauterbach and Ben-Zion use this information to determine the extent to which the previous day's order imbalance disappeared on the day following a trading halt. The results indicate that the halt eliminated some, but not all, of the imbalance.

These TASE crash results are subject to alternative interpretation, however. The decrease in the order imbalance could also be due to a reversal in valuations. If the price change following a large price change is random (as opposed to being a reversal due to the large price change or the trading halt), the TASE evidence is not particularly reliable. It is essentially the result of a one-shot event study.

Ma, Rao, and Sears (1989a and 1989b) examine limit moves in Treasury bonds, silver, corn and soybean futures contracts using event study methods. They find that prices tend to stabilize or reverse following a limit move. In their words, this evidence suggests that price limits provide a "cooling-off period" for the market.[19] They also find that volatility decreases following the limit move. The result, however, is probably due more to mean reversion in volatility than to the limit move.

On February 22, 1985, the Chicago Mercantile Exchange dropped price limits from all of its foreign currency contracts. Chen and Jeng (1996) compare volatility before and after the

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[19] Kuserk (1990) notes that the reversal may be due to the inclusion in the Ma, Rao and Sears analyses of some intraday price limits from which trading subsequently resumed. Be definition, these events are associated with reversals. See Ma, Rao and Sears (1990) for a rejoinder.

change. Although the study uses GARCH methods to model the time-structure in volatility, it is essentially a one-shot event study.

To avoid the tremendous difficulties associated with empirical studies of circuit breakers using historic market data, some researchers have turned to experimental methods. Coursey and Dyl (1990) examine the effects of price limits and trading halts in laboratory markets. They find that following the dissemination of significant news, the price adjustment process is most efficient when trading continues without a halt. Following a trading halt, price takes longer to find its equilibrium than when trading is unconstrained. The results for price limits lie between those for the unconstrained market and the market with the trading halt rule. These results suggest that trading halts are worse than price limits, and that neither is as good as simply letting the markets trade.

Although these experimental results are intriguing, we must treat them with some caution. Traders in the Coursey and Dyl markets trade primarily to rebalance their portfolios rather than to exploit private information.[20] Indeed, in their experiments, all traders had the same information. Since extreme volatility in the real world is due more to uncertainty about common values than to uncertainty about distribution of quantity among traders who value assets differently, these results may have limited relevance.

Collars

Several studies have examined the effects of Rule 80A on the markets using the methods described above.[21] McMillan and Overdahl (1998) provide the most recent and most comprehensive results. In a study of data through December 1993, they show that index arbitrage program trading at the NYSE declines by about two-thirds following 50 point moves. Arbitrage for agency accounts, which represent about 20 percent of the total arbitrage volume, essentially declines to zero. Somewhat surprisingly, the cash-futures basis following the rule does not widen. Apparently other mechanisms besides those restricted by Rule 80A keep the markets linked to each other. These mechanisms probably include quotation revision by the specialists and the use of quasi-arbitrage strategies that are exempt from the Rule. Using an error correcting model,

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[20] The various traders receive different payoffs for holding the asset at the end of the game. According, even in a full information environment, they will have different valuations.

[21] See NYSE (1991), Kuserk, Locke and Sayers (1992), Santoni and Liu (1993), and McMillan and Overdahl (1998).

they show that these mechanisms are not as strong as direct arbitrage: The basis adjusts more slowly towards its fair value when the Rule 80A collar is in effect. Volatility, as measured by minute-to-minute returns, however, declines at the NYSE when the collars are in effect, but it does not change in the futures market. The likely cause of the NYSE decline is increased serial correlation in the returns.[22] Finally, an examination of spreads shows that they are essentially unchanged before and after 50 point moves.

McMillan and Overdahl were unnecessarily conservative when constructing their control sample. They included in their control sample all the days, from October 1986 through July 1990, that the Dow moved by more than 50 points.[23] Since the index was substantially lower in the test sample, these 50 point moves represented more significant events in percentage terms than the 50 point moves that triggered Rule 80A in the test sample. Market conditions in the control sample therefore were probably more extreme than they should have been to obtain fair comparisons. It would have been better if the control sample were constructed by matching percentage returns rather than absolute price changes.[24]

The New York Stock Exchange (1991), Kuserk, Locke and Sayers (1992), and Santoni and Liu (1993) studies all examine shorter time periods. Their results are essentially similar to the McMillan and Overdahl results.

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[22] The authors recognize this possibility, but do not test directly for it. Instead, they examine volatilities estimated around what they call an unconditional mean rather than around the sample mean. In short autocorrelated samples, means can be estimated with substantial error. As a result, variances will be underestimated. Although they do explain how the unconditional mean is estimated, it is very likely that it is near zero. The results show higher variances, as expected, but the qualitative result – lower volatility when the collar is in effect – is still present.

This technique is best suited to correcting for the effects on volatility of very low frequency autocorrelation. The autocorrelation due to the restriction on arbitrage imposed by the collar is likely to be at much higher frequencies. It would have been better to examine the autocorrelations directly.

Indirect evidence of the positive autocorrelation can be obtained from their estimated error correcting model. The decrease in the speed of adjustment is almost certainly associated with an increase in serial correlation.

[23] Although not mentioned in the text, they apparently exclude days associated with the October 1987 Crash and the October 1989 mini crash.

[24] McMillan and Overdahl in Footnote 7 argue that the 50 point standard is appropriate because "the rule has stayed with 50 points since its initial implementation and we believe that specifying point changes rather than percentage changes is consistent with how the rule would have been administered had it been in place during our control period." This argument ignores the fact that the market conditions associated with the triggering of the Rule will likely change as index levels change.

Margins

Many studies examine the effect of margin requirements on volatility with mixed results.[25] Rather than discuss separately the many studies that have examined the issue, I will discuss only the most influential papers and those that illustrate the empirical difficulties associated with all these analyses.

Researchers have used two main types of analyses to investigate the effect of margins on volatility. They have used time series regressions to characterize the relation between volatility and the level of the required margin and event-study analyses to characterize how volatility changed around changes in the margin requirement.

Hardouvelis (1988, 1990) uses time-series regressions to identify a small negative association between margins and volatility in the United States. The result, however, may be due to why the Federal Reserve Board changed margins. Schwert (1989) and Miller and Hsieh (1990) show that changes in margin requirements tend to follow changes in volatility. In particular, the Fed tended to raise margins when volatility was high and to lower them otherwise. Since volatilities tend to be mean reverting even without changes in margin requirements,[26] the Fed policy tended to associate high margins with lower volatilities and vice versa. It is thus not clear whether the causality goes from margins to volatility or vice versa. In any event, the Hardouvelis time-series regression result is not very robust. Miller and Hsieh (1990) show that the correlation apparently comes only from a few observations in the last 1930's and early 1940's.

If margins do affect speculation, they should have differential effects on the volatilities of stocks classified by their appeal to speculators. Using four measures of appeal, Kumar, Ferris and Chance (1991) examine this hypothesis. They find only very weak support for this hypothesis.

Several researchers have attempted to determine whether futures margins affect futures volatility. Ma, Kao and Frohlich (1993) examine the role of margins in the Silver futures market, which experienced a severe bubble in between July 1979 to April 1980. During that period, regulators used margins and speculative limits to control speculation in the market. They conclude that margins affected trader behavior during this period and also during more normal trading periods. They note, however, that markets tend to increase margins when price volatility

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[25] Kupiec (1997) provides a current survey of these results. An earlier survey appears in France (1990).
[26] Consider, for example, volatility in the post 1974 period when U.S. stock margins have been constant at 50 percent.

is high and to decrease them when price volatility is low. Given the mean reversion in volatilities, the actual effect of margins on volatilities is hard to identify. Hardouvelis and Kim (1995) provide similar analyses for all metal futures markets with similar results.

Goldberg and Hachey (1992) analyze the foreign exchange futures markets and Fishe, Goldberg, Gosnell and Sinha (1990) analyze futures on agricultural commodities. Both studies find that changes in volatility cause changes in margins, but not vice versa. For those markets, like the foreign exchange markets, where the futures market is small compared to the cash market, this result is not surprising. The cash markets typically are not subject to margin regulation.

Transaction Taxes

No empirical study of which I am aware examines the relation between transaction taxes and volatility. For a given market, transactions taxes change too infrequently to reliably estimate their effects on volatility. Any such study essentially would be a one-shot event study subject to the problems of confounding explanations described above. Although it may be possible to examine the relation between transaction taxes and volatility across markets, such studies would also probably be quite weak because other more important differences across markets would likely obscure any effect due to transaction taxes.

The first order effect of a transaction tax is on trading volume. Ample evidence demonstrates that taxes do decrease volumes. Perhaps most notably, Ericsson and Lindgren (1992) find that cross-market variation in transaction taxes helps explain the cross-section of market trading volumes. Other evidence often cited by authors includes increases in volumes associated with decreases in security taxes in Stockholm, Paris, and with fixed commissions (which are essentially the same as transaction taxes) in the U.S.

International Evidence from the 1987 Crash

The October 1987 Stock Market Crash affected markets around the world. Roll (1988) examines whether the price drops experienced in the various national markets can be attributed do cross-sectional differences in their trading halt, price limit, and margin rules. His results suggest that these rules did not significantly explain differences in how these market performed during the Crash. These effects of these rules are either not important, or they were overwhelmed by the effects of more important factors.

5.3 Summary

The empirical evidence relating trading halts, price limits, collars, margins and transactions taxes to volatility is generally quite scant. Efforts to assemble this evidence are complicated by the lack of meaning data, the overabundance of alternative explanations for volatility, and an inability to identify whether changes in policies cause volatility or follow volatility. The only statement that we can make with confidence is that none of these policies has such a large effect on volatility that we can easily identify it.

6. Political Economy

Before concluding, we will speculate on why markets adopted circuit breakers and on why they remain in place. These questions are interesting because we really do not know whether their benefits outweigh their costs. As discussed above, the theoretical results are ambiguous and the empirical evidence is scant. This short section suggests some political reasons behind the support for circuit breakers.

Two models help explain the support for circuit breakers. The first is based on asymmetries in how regulators weigh Type I and Type II decision errors. Briefly, following an extreme event, regulators tend to overreact because they fear being blamed for failing to act should the event reoccur. This model may explain why the markets adopted the trading halts and the price limits that they did. The second model is a rent-seeking model. It may explain why the NYSE adopted the Rule 80A collars.

Immediately following the 1987 Crash, many people demanded that regulators act to prevent future crashes. Whether regulators have this power or not and whether their actions would impose serious costs upon the market were questions that fewer people considered.

Given this environment, we can easily imagine that regulators in the government and in the exchanges reasoned as follows:

- "If we fail to adopt some circuit breakers and another crash occurs, the public will hold us responsible for failing to protect the public, regardless of whether the circuit breakers would – or even could – have made a difference.

- If we fail to adopt some circuit breakers and no crash occurs, we will have saved whatever costs the circuit breakers might impose upon the markets, but nobody will credit us with our wisdom.

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- If we adopt circuit breakers and another crash occurs, people will learn that we cannot prevent crashes, but they will not blame us for not trying.

- If we adopt circuit breakers and no crash occurs, people may credit us with preventing another crash, even if the circuit breakers are not effective. Although we will be responsible for imposing potentially costly and unnecessary restrictions on the market, these costs may not be recognized, and probably will not be attributed to us."

Table 1 summarizes these contingent costs and benefits. Given this information, the regulators should adopt some circuit breakers, whether or not another crash occurs.

Table 1: Contingent Values for Adopting or Not Adopting Circuit Breakers

This table summarizes how the net benefits that accrue to regulators depend on their decision to adopt circuit breakers and upon whether another crash occurs in the future. Given these assumed values, it is optimal for regulators to adopt circuit breakers.

	Adopt circuit breakers	Don't adopt circuit breakers
Another crash follows	No cost	High cost
No crash follows	Some benefit	No cost

The SEC, CFTC and the various exchanges adopted various circuit breakers following the Crash. The Federal Reserve Board, which is responsible for setting security margins, did not. We may attribute the reluctance of the Federal Reserve Board to raise margins to its greater independence from political and popular pressures and to its primary focus on monetary policy.

Consider now the decision to adopt mild or severe circuit breakers. Mild circuit breakers are unlikely to significantly change trading whereas severe circuit breakers will alter the character of trading. Regulators may have reasoned as follows:

- "If we adopt mild circuit breakers and another crash follows, we may be faulted for not acting more strongly. Judgment will be somewhat reserved, however, since many may conclude from the second crash that regulators cannot prevent crashes.

- If we adopt severe circuit breakers and another crash follows, most will conclude that regulators cannot prevent crashes. Some, however, will claim that had the severe circuit

breakers not been in place, the unconstrained market would have been able to handle the crisis. We may be blamed for causing the crash.

- If we adopt mild circuit breakers and no crash follows, we will have had little effect on the markets.

- If we adopt severe circuit breakers and no crash follows, we will be faulted for overreacting."

Table 2 summarizes these contingent valuations. Taken together, they suggest that the regulators should adopt mild circuit breakers, which they did. The NYSE trading halt rules (and the associated futures trading halt rules) have never been triggered. Although large price changes frequently trigger Rule 80A, it has little effect on the markets besides frustrating index arbitrageurs. Only the 12 and 30 point price limits on the S&P 500 futures contract have been triggered. The CME may have adopted somewhat stronger limits than the NYSE because traders there are subject to lower margins than at the NYSE. The difference may also be due to concerns by the exchange that they not be blamed for causing another stock market crash.

Table 2: Contingent Values for Mild and Severe Circuit Breakers
This table summarizes how the net benefits that accrue to regulators depend on whether they adopt mild or severe circuit breakers and upon whether another crash occurs in the future. Given these assumed values, it is optimal for regulators to adopt mild circuit breakers.

	Adopt mild circuit breakers	Adopt severe circuit breakers
Another crash follows	Some cost	Possibly high cost
No crash follows	No cost	High cost

The conclusions in these simple analyses obviously depend on the assumed contingent valuations. If you make other assumptions, you may obtain different conclusions, or you may not be able to obtain any conclusions without assuming additional information about the probabilities of future crashes. These assumptions seem reasonable to me, but you may think otherwise.

The conclusions implied by these assumptions are consistent with well-recognized regulatory behavior. Regulators often respond to crises with policies that may have little or no

actual impact. For an extreme example, consider the imposition of odd/even gas rationing during the 1974 oil crisis. When the public demands action, regulators tend to act. But when faced with uncertainty about the consequences of regulatory actions, regulators frequently fail to act decisively. They do not want to be blamed for exacerbating a problem or for creating new problems. For example, it took the SEC five years to approve trading in SuperUnits and SuperShares following the Stock Market Crash even though these contracts were completely collateralized versions of existing index futures and index options contracts. When regulators do act decisively, they usually have a strong political mandate based on a clearly defined ideology. Consider, for example, deregulation in the Reagan years. No such mandate for extreme change followed the Crash.

Although a similar analysis may explain the Rule 80A collars, a rent-seeking model probably is more useful.[27] Holden (1995) shows that arbitrageurs compete with specialists to supply liquidity. Both traders move liquidity between buyers and sellers who are unable or unwilling to trade with each other. Arbitrageurs construct hedge portfolios to move liquidity from one market to another at one point in time. Specialists use their inventories to move liquidity from one point in time to another within their market. The two types of traders compete in the following sense: When either trader cannot act, the profit opportunities for the other are greater. Since Rule 80A restricts index arbitrage, it benefits specialists at the expense of arbitrageurs.

Specialists also benefit from Rule 80A because it helps them avoid trading with arbitrageurs. When a specialist provides liquidity to an arbitrageur, the specialist is often on the wrong side of the market. For example, if futures market is falling and the cash market is lagging behind, arbitrageurs will be selling to specialists. The specialists will be buying stock at prices that very likely are too high and will thereby lose money.

To apply the rent-seeking model, we need only convince ourselves that specialists have more power at the NYSE than arbitrageurs. If power were only based only on relative numbers, the specialists certainly would dominate the arbitrageurs. Far more members of the NYSE conduct specialist operations than arbitrage operations. As of November 1997, 470 of the 1366 members of the Exchange are full-time specialists. Compare this number to the 20 members who

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[27] Kurserk, Locke, and Sayers (1992) also suggest this conclusion.

conduct 95 percent of the program trades.[28] Although the comparison is overwhelming, it is not necessarily conclusive. The members who conduct major arbitrage programs tend to be very large broker-dealers whose influence at the Exchange may be disproportionate to their numbers. Two other arguments, however, further support our conclusion. First, the loyalties of the independent floor broker community lie primarily with the specialists with whom they deal rather than with the large broker-dealers with whom they compete. Second, the interests of the senior management of the exchange are more likely aligned with the specialists than the arbitrageurs. Specialist trading exclusively benefits the NYSE whereas arbitrage trading benefits the competing futures market and is widely believed to be a cause of volatility at the NYSE. Taken together, these arguments suggest that specialists are more powerful than arbitrageurs at the NYSE. It is therefore not surprising that the NYSE proposed and adopted Rule 80A.

The rent-seeking model helps explain three significant differences between the Rule 80A collars and the trading halt circuit breakers adopted by the NYSE: First, Rule 80A is triggered by much smaller price changes than the trading halts. Second, Rule 80A applies both to price decreases and price increases. Finally, unlike the trading halts, the NYSE has not amended Rule 80A to adjust its trigger for the increase in index levels over the last ten years. The rent-seeking model suggests that the Exchange will set the trigger to interfere with arbitrage trading as often as possible (as long as the rule does not hurt the other members). These three differences between the NYSE collars and the NYSE trading halts all ensure that the collars will be triggered more often.

7. Conclusion

The 1987 Stock Market Crash produced much demand for more regulation of the stock and stock futures markets. This demand, in turn, generated many studies of whether new measures would advance the public good.   Unfortunately, ambiguous results characterize the theoretical studies. Due to a lack of relevant data and the presence of numerous credible alternative explanations for volatility, the empirical studies do not provide much guidance.

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[28] These data were supplied by the NYSE Office of Research and Planning. The comparison is more impressive than it seems since not all program trades involve index arbitrage.

When presented with this uncertainty, what should a regulator do? Hopefully, regulators will be able to separate most important issues from lesser issues when considering the effects of regulatory policies on the markets.

Following is my list of issues of first-order importance:

- Respect the needs of investors, hedgers, and asset exchanges who use the markets for utilitarian purposes. Without these utilitarian traders, the markets would not exist. Policies that make their trading more expensive are probably counter-productive in the long-run.

- Recognize that when traders compete to supply liquidity, failures to provide adequate liquidity to uninformed traders tend to be self-correcting. Such failures create extremely profitable trading opportunities. Liquidity suppliers learn from them and plan to act more profitably in the future.

- Accurate prices are extremely important to our economy. Large price changes do not necessarily indicate a problem with the closing price. The problem might have been with the opening price. Measures that complicate or slow the price discovery process probably are not desirable.

- Externalities are important. For example, limit order traders give away options to trade for which other traders do not compensate them. Measures that protect their interests will increase liquidity.

Regulators may find one final perspective useful. As shown above, circuit breakers help markets compensate for other weaknesses in the trading process. For example, when brokers cannot collect margins continuously in real time, trading halts give them time to collect margins. When order flow exceeds the processing capacity of a market, trading halts protect traders from trading in an informationally disorganized market. These roles for circuit breakers are becoming less important as the markets have grown and matured. Innovations in information processing technologies have allowed for faster collection of margins, and for increases in order processing capacities. Circuit breakers may therefore be less important in the future than in the past.

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