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The Impact of the Introduction of Index Futures on Volatility and Noise Trading

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Abstract

The paper examines the impact of index futures on volatility and noise trading. Academic interest in the issue has been on the rise since the late 1980s, when derivatives were considered the key cause of the October 1987 US market crash; however, studies have been unable to arrive at a definite conclusion about the impact of index futures. On the one hand, several studies claim that index futures cause an increase in spot volatility due to the dominance of either rational or noise investors at the futures segment. On the other hand, several other studies suggest that the dominance of rational traders in the futures markets implies greater efficiency in futures pricing, followed by a reduction in spot volatility. This paper analyses contrasting theoretical approaches and empirical evidence relating to the issue. The paper concludes that the issue remains unresolved, despite the many years of research that have gone into investigating the impact of index futures. The policymaking implications and possible regulatory measures associated with index futures are also discussed in this paper.

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I. Introduction

A derivative is a financial instrument whose value is benchmarked to another underlying asset, such as a market index, a stock, a commodity, or an interest rate. Derivative products can assume various structural formats including futures, options, and swaps, and they have grown to become important tools for portfolio diversification, price discovery, and risk hedging. With economies developing and financial systems becoming increasingly sophisticated and integrated globally, the analysis of such parallel markets has become significant.

The current study is centred on index futures. Some crucial definitions are provided at the outset to present a clearer picture of the issue under discussion. A futures contract is an agreement to make an exchange in the future. It does not necessarily involve an exchange of assets in the future; for instance, in the case of index futures, the buyers and sellers of the index settle (or square off) their positions by taking offsetting positions (Becketti and Roberts, 1990). Close to expiration, futures traders may close their positions by squaring off (i.e., by taking a position opposite to the initial one), by physical delivery, or by paying the difference between the futures price and the spot price of the underlying asset. They play a significant role in the market as information is expected to flow from one market (futures) to another (spot) by the virtue of linkages. However, these financial instruments are not always perceived in a positive manner, as they are controversially considered to be used by speculators. Examining the relationship between index futures and their underlying markets could provide valuable insights for understanding the dynamics of the two markets (Antoniou et al., 2005).

The issue pertaining to the impact of index futures on the volatility of the underlying spot market has increasingly received the attention of researchers and policy makers alike. This is primarily due to the destabilising perception surrounding index futures in the context of several stock market crashes, such as US market crash of 1987, the US flash crash in 2010, and the Indian stock market crash in 2008 (discussed in Section IV). Critics point out that wild, volatility-inducing price swings have occurred in the underlying markets on the

expiration day of certain futures. Such expiration-day volatility occurs when stock index arbitrageurs holding cash positions that are related to futures positions unwind their positions at the termination of trading in futures contracts (Edwards, 1988a). Based on this, some people blame the index futures markets for a rise in stock market volatility. Is this necessarily an undesirable consequence? Does the introduction of index futures have stabilising or destabilising effects on the underlying market? These questions have been widely debated to arrive at appropriate policy and regulatory responses. The aim of this paper is to examine the theoretical underpinnings of this debate, and to cite the empirical findings as well.

The rest of the paper is organised as follows: Section II discusses the theoretical debate and summarises the empirical literature on index futures as promoters of volatility. Section III outlines the theoretical and empirical investigation on the stabilising role of index futures on the underlying market's volatility. Regulatory and policy implications are presented in section IV, and Section V concludes the discussion.

II. Index Futures as Tools Promoting Volatility

Derivative products are used either to hedge some pre-existing risk by taking positions in the derivative markets that offset potential losses in the underlying spot market, or for speculative purposes such as taking positions to profit from anticipated price movements.

Volatility is an area of interest for regulators as well as investors, since excess volatility can increase the risk inherent in stock market returns. There are two components to stock market volatility: volatility arising due to information-based changes and volatility arising due to noise trading. In the former case, volatility increases due to the rise in the participation of informed investors who rationally process all fundamentals-related[2] information and condition their trades upon it; in the latter case, volatility is the result of uninformed investors trading for reasons other than the fundamentals. This type of trading has been dubbed "noise trading" (Black, 1986; De Long et al., 1990), and involves any trading strategy based on non-fundamental indicators, including for example, technical analysis and investor-sentiment. The presence of noise trading can cause prices to deviate substantially from fundamentals (De Long et al., 1990) and give rise to jump-volatility[3] (Becketti and Sellon Jr., 1989), i.e., occasional and sudden extreme fluctuations ("shocks") in prices. This is certainly of concern

[2] The term "fundamentals" is used in this context to describe any information related to the intrinsic value of a firm, such as earnings, dividends, cash flows, and so on.
[3] In the absence of noise traders, volatility would be expected to follow a more normal pattern in its distribution, which Becketti and Sellon Jr. (1989) have termed "normal volatility."

to regulators, since such shocks can lead to potentially destabilising outcomes—a highly volatile environment with abrupt price swings would result in a high probability of market bubbles and crashes. Next, we examine how index futures boost volatility in spot markets due to one of the following two possibilities:

a) Informed traders dominate futures' trades, resulting in an increase of information-based trading in the futures' markets. Given the linkage between the spot and futures segments, this enhanced flow of information and its incorporation into prices at the futures' level has a knock-on effect on the spot level, leading to an increase of volatility there.

b) Noise traders dominate the futures' markets, leading to mispricing at the futures' level, which is then carried forward to the spot level. As this mispricing is associated with a substantial departure from the fundamentals, this leads to a rise in volatility at the futures' level, which is later transmitted to the spot level.

In the rest of this section, we develop each of these two arguments from a theoretical viewpoint and briefly present evidence from empirical research that is relevant to each.

A) Index Futures Increase Spot Volatility: the role of informed traders

The issue here relates to the case where rational investors[4] dominate the activity at the futures' level. From a theoretical viewpoint, rational investors are attracted to the futures' markets due to the low costs of transaction inherent in them as compared to the spot markets. To own a futures contract, investors only have to put up a small fraction of the value of the contract as margin. Thus, investors can trade a much larger amount of the asset instead of buying it outright. Low transaction costs facilitate investors' participation and imply higher liquidity, and this is a *sine qua non* condition for the participation of rational traders in any market, as it guarantees their ability to enter and exit their positions in a timely fashion. If rational traders end up dominating index futures, their high quality information would be

[4] The terms "rational" and "informed" traders are used interchangeably in this context to denote the same trader type, namely, one whose investment decisions are based on the processing of fundamentals. While such a trader type could simply be called "informed" (given that his/her trades are information-based), we feel compelled to describe him/her as rational as well. This is because we wish to emphasise that this trader type not only trades on information but also processes it in a rational way. Rationality here refers to the strict Bayesian updating (i.e., individuals update their beliefs correctly upon receiving new information), utility-maximising conduct described in Barberis and Thaler (2003). It may well be the case, however, that an investor uses fundamental information, but not in a rational fashion; such an instance is discussed in Barberis et al. (1998), where investors try to detect patterns (trending or reverting ones) in companies' earnings. Although earnings in this case constitute a piece of fundamental information, its processing in the context under discussion does not subscribe to rationality as it involves the identification of patterns rather than the rational interpretation of earnings per se as a piece of information (Barberis et al., 1998).

transmitted to the spot market segment through an alternative channelling route (i.e., the futures market), something that is clearly beneficial from an efficiency viewpoint (Cox, 1976). However, this also implies that the flow of information from the futures market to the spot market would increase, leading to a rise in the volatility of spot prices (Ross, 1989). From a practical perspective, such an increase in volatility should be welcome, since the dominance of rational investors in futures markets would suggest that any deviations from the fundamentals at the spot level would be arbitraged away, leading to greater stabilisation in capital markets. Another positive effect of this is that the domination of the futures markets by rational investors will lead to a boost in the liquidity of spot markets, thus reducing market frictions (e.g., thin trading)[5] at the spot level. The problem with the hypothesis that volatility increases post-futures because of rational investors is the limitations encountered in actual practice. Although arbitrage is attained through index futures, it may be the case that a market's institutional framework produces obstacles to its smooth practice. It could be, for instance, that there are restrictions in futures trading that limit the activities of those trading in the futures markets. It may also be the case that the spot market is dominated by noise traders for a prolonged period of time, thus rendering any correction of spot prices through futures harder to attain.

Empirical evidence for the increase in volatility following the launch of index futures due to information-based trading has been provided in several studies. Antoniou and Holmes (1995) and Antoniou et al. (1998) documented an increase in spot volatility following the introduction of the FTSE 100 index futures contract for the London Stock Exchange. Their results were in line with those presented in Ross (1989), as the increase in volatility following futures trading was due to greater informational efficiency rather than destabilising speculation. Nagaraj and Kumar (2004) studied the impact of index futures trading on spot market volatility using the data from June 2000 to February 2003 of the S&P CNX NSE Nifty. They found that the increase in the spot market volatility was due to the market becoming more efficient and assimilating the information into its prices.

[5] Thin trading is the situation where the lack of sufficient volume renders it impossible for the market to clear, leaving a series of orders unfulfilled. Under such conditions, prices do not change continuously, presenting themselves instead with pockets of inertia (i.e., they remain unchanged for several days, as low volumes deter trading on them).

B) Index Futures Increase Spot Volatility: the role of noise traders

In the previous section, it was postulated that futures trading is more likely to be conducted by rational investors; however, the impact of noise traders should not be neglected. The issue here is that noise investors find futures as instruments to be an attractive option due to the lower costs of transaction associated with their trade. A noise investor who has traded in the spot market segment to date will welcome the launch of the futures market since the latter will provide him/her with an additional route to apply his/her non-fundamental trading strategies. How this strategy can increase volatility in the underlying spot market is discussed next.

One possible development is for volatility to evolve due to the sole effect of noise trader participation. In this case, noise investors assume a dominant position in futures' trading and their trades begin to exert an influence over the spot segment. If the futures' prices are "wrong" (over- or under-priced), this will be reflected into the underlying spot market, affecting pricing there too. The wild swings in prices irrespective of fundamentals expected will tend to amplify volatility at the spot market level, enhancing its riskiness.

Although this is a plausible scenario, the probability of noise traders taking over the volume of trade of the futures market is relatively low. It is perhaps more likely to assume that any increase in spot volatility due to the presence of noise traders would be the result of their interaction with rational investors. Once rational investors witness an increased presence of noise traders, the first anticipated reaction on their part would be to try to arbitrage away any mispricing. The problem is that this strategy may not always be feasible. Noise traders may exhibit persistence in the strength and duration of their impact, to the extent that arbitrage becomes more costly. Under such conditions, it makes more sense for rational investors to track the trades of noise investors with the purpose of exploiting them. This scenario, which leads to a prolonged departure of prices from the fundamentals, was outlined in De Long et al. (1990). If such a situation arises at the futures level, it is only reasonable to assume that it would produce a mispricing with obvious repercussions on volatility at the spot level.

On the empirical side, Harris (1989) showed that uninformed speculative trading in the futures market added noise to the spot market, and decreased the information content of the spot price. He observed an increase of volatility of the S&P 500 index after the introduction of futures trading. Similarly, Lee and Ohk (1992) showed that volatility in the underlying

stock market rose after the introduction of futures trading. An increase in asymmetric volatility after the introduction of index trading can lead to an excessive increase of stock market volatility. Most of these studies based their arguments on the high degree of leverage attracting uninformed traders, leading to volatility. Shang (2001) argued that the volatility of stock returns in the US, France, and Australia rose significantly, while no significant changes in volatility were observed in the UK and Hong Kong after the introduction of index futures. This variation in results could be attributed to macroeconomic factors and different market structures.

The link between noise traders and volatility following the introduction of index futures was directly addressed by Antoniou et al. (2005). The authors employed a particular non-fundamentals trader type, namely, feedback traders,[6] as proxy for noise trading. The empirical design used involved the interaction of feedback traders with rational traders, controlling for volatility persistence over time, and was tested in a series of developed capital markets. Their results indicated the significant presence of feedback traders prior to the launch of index futures, with this significance disappearing post-futures. Perhaps more interestingly, the authors reported no evidence of feedback traders migrating to the futures segment following the launch of the futures market.

In the next section, the role of rational investors on the volatility of markets is discussed.

III. Index Futures Dampen Spot Volatility: The role of rational investors

Another school of thought argues that the introduction of index futures reduces volatility and stabilises the cash market by providing low cost contingent strategies that enable investors to minimise portfolio risk by transferring speculators from the spot to the futures market. Index futures enable investors to trade large volumes at lower transaction costs, improving risk sharing and thereby reducing volatility (Cox, 1976; Stein, 1987; Ross, 1989, Chan et al., 1991). Abhyankar (1995) finds support for the hypothesis that lower transaction costs is the primary reason for traders with market wide information to use the futures market. In the model developed by Stein (1987), prices are determined by the interaction between hedgers[7]

[6] Feedback traders base their decisions upon recent trends. Positive (negative) feedback trading implies that investors buy when prices rise (fall) and sell when they fall (rise).

[7] Hedgers try to reduce the risk of an adverse price movement in asset. For instance, they trade futures to secure the future price of a commodity that they will take delivery of and later sell in the cash market. By buying or selling futures contracts, they protect themselves from future price risks.

and informed speculators. This model demonstrates that futures markets act as an essential tool for risk management by reducing volatility. The model developed by Froot and Perold (1991) demonstrates that futures markets cause an increase in the market depth due to the presence of more market makers[8] in the futures segment than in the cash market and the more rapid dissemination of information.

At the empirical level, the majority of researchers support the argument that the introduction of index futures stabilises the spot market by reducing volatility. Kawaller et al. (1987) showed that movements in the index futures market led to movements in the spot market; however, this did not have a destabilising effect as the movements reflected the ability of the futures markets to process information faster. On investigating the relation between stock return volatility and the introduction of index futures, Edwards (1988a) found no rise in volatility subsequent to the introduction of index futures. Cox (1976) found that the introduction of futures markets led to greater informational efficiency, as they were relatively inexpensive, with low margin requirements and low transaction costs.

Bologna and Cavallo (2002) examined the effect of the introduction of stock index futures on the volatility of the Italian spot market, and found a reduction in spot market volatility and enhanced market efficiency. They attributed this phenomenon to the increased impact of recent news and a reduced effect of the uncertainty originating from the old news.

Pericli and Koutmos (1997) analysed the impact of the US S&P 500 index futures on spot market volatility. Their results showed that index futures did not have an escalating effect on spot market volatility.

On examining the stock market volatility before and after the introduction of index futures in 25 countries, Gulen and Mayhew (2000) found that index futures had no significant effect on the spot markets in all the countries studies except the US and Japan. Further, they found that spot volatility was independent of changes in futures trading in 18 countries, and that uninformed futures volume had a negative impact on spot volatility in Austria and the UK.

[8] A "market maker" is a firm that is ready to buy and sell a particular stock on a regular and continuous basis at a publicly quoted price.

Schwert (1990), Backetti and Roberts (1990), Darrat and Rahman (1995), Kamara et al. (1992), Perieli and Koutmos (1997), Spyrou (2005), and Alexakis (2007) all arrived at similar conclusions, thus confirming the stabilisation theory.

In the Indian context, Raju and Karande (2003) found a reduction in spot market volatility after the introduction of index futures; Thenmozhi and Thomas (2004) found a reduction in volatility in the underlying stock market and increased market efficiency following the launch of NIFTY-linked futures.

The regulatory and policy implications that follow from this discussion are presented in the following section.

IV. Regulatory/Policy Implications & Suggested Measures

The impact of the introduction of index futures on the underlying stock markets is of primary concern for regulatory agencies, exchanges, and investors. Derivative instruments play a crucial role in market completion and the price discovery process. If futures trading increases stock market volatility, the regulatory agencies might conclude that restrictions on futures trading would be required in the interests of the public, as this increased volatility could lead to destabilising effects such as market bubbles and crashes[9] similar to the dot-com bubble in 2000 and the US housing bubble and credit crisis (2007–2009).

However, as was discussed earlier, volatility per se need not be detrimental, if its roots can be traced to the quicker integration of information into prices through the additional channel of index futures.

Therefore, the issue here is to devise policy responses that take into account not only volatility in itself, but also the sources underlying it.

A natural obstacle to this is the fact that the traditional views on the benefits of futures have not always been acceptable to the regulators. There have been increasing concerns since

[9] A bubble is a situation in which temporarily high prices are sustained largely by the investors' enthusiasm rather than by consistent estimation of the real value (Shiller, 2000). A crash is a significant and unexpected drop in the total value of the market, resulting in large capital losses.

futures trading has been blamed for many well known market crashes such as the 1987 US market crash, the 2010 US Flash Crash, and so on, which justify more stringent regulation. The declining markets in the US in 1987 pushed more investors into the futures markets, where they sold futures contracts as a hedge against falling stocks. This increased sale of futures contracts led to a discrepancy between the value of the stock index in the futures market and the value of stocks on the NYSE. Index arbitrage traders took advantage of this price discrepancy to buy futures and sell stocks, transmitting a downward pressure to the NYSE. On January 21, 2008, the SENSEX saw its highest ever loss of 1,408 points at the end of the session due to massive unwinding seen in stock index futures (Moneycontrol, 2008). More recently, a mutual fund started a programme to sell USD 4.1 billion in E-mini futures using computer sell algorithms on May 6, 2010 (as stated by the Securities and Exchange Commission and the Commodity Futures Trading Commission). This pressure was transferred from the futures to the stock market leading to a significant decline in prices.

These episodes continue to worry financial regulators, leading them to view index futures as the key culprits underlying equity market volatility. Although these concerns are valid (given the high social costs involved in a potential chain of defaults by financial intermediaries due to excess volatility), regulators need to search for improved insight into what leads volatility to increase due to index futures, instead of blaming the futures market itself.

The extant regulatory response includes a series of measures, such as transaction taxes, increased margins, and circuit breakers in order to curb volatility; the rationale underlying these measures is explained in below (Edwards, 1988b).

A) **Transaction Taxes**

Stiglitz (1989) and Summers and Summers (1989) argued that transaction taxes help reduce noise trading (which is a significant source of price fluctuations), hence decreasing volatility. However, it has been observed that transaction taxes prevent instant price adjustment according to new information, and cause price jumps and higher volatility. Umlauf (1993) found that the introduction of (or increase in) transaction taxes in Sweden led to an increase in stock market price volatility.

This issue is rather hard to assert either way, and is subject to speculation. In general, if trading taxes rise, those with less funds available for investment—traditionally, retail investors, who are according to Barber et al. (2009) the prime candidates for noise trading—

would be expected to refrain from frequent trading. From this perspective, therefore, increasing the cost of trading through higher taxes would lead to less noise in the markets, improving their efficiency (noise trading introduces "noise" in the price-content) and dampening volatility (at least the part of it that is due to noise traders). The problem, however, is that transaction taxes are also unwelcome from the perspective of informed investors. They would view such taxes as a market friction disallowing their at-will trade, suggesting that they may end up not trading any time their information would urge them to do so (Romano, 2007).

Moving to the domain of index futures, the concept of a Tobin tax,[10] a transaction tax on trading, enjoys great popularity as a potential means to reduce market volatility and as a source for tax revenues. However, this is expected to have adverse effects on the volume of trade for the same reasons that were mentioned earlier. Interestingly enough, there is no consensus on the consequences of a Tobin tax on price volatility; the effects depend on the liquidity of the market and on the magnitude of the tax. Financial transactions taxes (FTT) are currently receiving considerable attention from policymakers (IMF, 2011; Matheson, 2011). Advocates for FTTs claim that they will help raise revenue, discourage destabilising speculation, and improve the informational efficiency of financial markets.

The tax treatment of index futures, though related to the volatility they are assumed to generate, does not take into account the sources of this volatility.

Discouraging noise traders is important, and probably desirable; however, it could be argued that noise traders contribute favourably to the liquidity of markets (Black, 1986), and are therefore, useful components of the investor population.

Given the positive relationship between volume and volatility (Karpoff, 1987), a drop in the participation of noise traders in the futures market would certainly lead to a decline in the volatility induced by their trades, but would also lead to a decline in liquidity. As liquidity declines, trading costs are bound to rise (with or without taxes), which is undesirable from an informed trader's perspective. Thus, in their effort to curb volatility using taxes as a tool, regulators may end up creating more problems without necessarily resolving the original one (volatility).

[10] Tobin tax is a concept that has been widely debated; however, it has never been implemented.

B) **Increased Margins**

Futures margins are like security deposits that ensure traders honour their contractual obligations. The US Securities and Exchange Commission (SEC) calls for higher margins on index futures as low margins lead to increased speculative trading (Edwards, 1988b). The smaller the margin in relation to the cash value of the futures contract, the higher is the leverage. As a result, a slight downward movement in the price of the futures contract will result in huge losses compared to the margin deposit. Thus, lower margins may contribute to an increase in concentrated institutional trading, resulting in greater price volatility. Higher margin requirements lead to higher transaction costs, and help to limit the volume of futures trading, reduce speculation, and increase market stability (Becketti and Roberts, 1990). However, it is not clear that less speculative trading will diminish the magnitude of price movements in either direction. Therefore, there is no reason to believe that higher margins will reduce price instability in either the stock or the futures markets. The only certainty is that they will impose higher costs on investors and traders, and reduce trading volume and liquidity.

C) **Short Selling Restrictions**

Under normal market conditions, short selling contributes to price efficiency and adds liquidity to the markets.[11] However, during crises, unrestrained short selling contributes to sudden price declines in securities that are unrelated to their true price valuation. Short sellers sell borrowed shares with plans to buy them back later at a lower price. In the absence of restrictions on short sales in the derivative markets, the greater leverage of futures creates a potential for greater speculative selling than would occur in the stock market. Through index arbitrage, selling activity can be transferred to the stock market. On September 19, 2008, the US Securities and Exchange Commission and the UK Financial Services Authority took emergency actions to prohibit short selling of financial stocks to protect the integrity and quality of securities. Such drastic measures are taken when there is a threat to capital markets and investors. France, Italy, Spain, and Belgium banned short selling of the shares of banks and other financial companies in August 2011. There were persistent rumours that European banks were in trouble; hence, a ban on short selling was imposed to restrict the benefits that

[11] Short sellers add liquidity to the market because they have to cover their positions eventually by buying back the stock, often when everybody else wants to sell. Without short sellers, prices would fall even further.

could have been achieved by traders selling borrowed shares, hoping to buy them back at a cheaper rate. This would have further worsened the banking crisis.

D) **Imposition of Circuit Breakers**

Another type of regulatory measure that is widely used is the circuit breaker rule. This rule (NYSE 80 A) was established in 1990 in the US in order to reduce excess market volatility by adding frictions to the linkage between the cash and the futures markets. The Japanese government has long employed a number of regulatory circuit breakers to restrain market volatility and to guide share prices (Hale, 1988). Trading in German Bund futures was briefly stopped on January 7, 2011 due to a spike in price volatility following the release of US non-farm payrolls data (Reuters, 7th Jan 2011).

The circuit breaker rule is implemented to prevent index arbitrage traders from further pushing individual stock prices in either rising or declining markets (Goldstein et al., 1990). When violent price movements exceed certain thresholds, the circuit breaker rule suspends trading activity. It is believed that suspending trading prevents incipient panics, and gives traders sufficient time to re-evaluate market conditions so that they can bolster their liquidity and credit (Morris, 1990).

However, there is another side to the story. Clearing houses face increased credit risk by implicitly extending margin credit to loss-making traders who need to make additional margin payments (Moser, 1990). A halt in trading due to a circuit breaker makes the true market price change substantially, which creates extreme losses for traders, causing them default on their contracts and forcing clearing houses to assume the obligations of failed traders. Thus, circuit breakers may increase market volatility unintentionally, as market participants try to buy or sell futures frantically to avoid being locked in. Subrahmanyam (1994) points out that in the US, circuit breakers have had a perverse effect on increasing price volatility prior to the triggering, due to the "magnetic effect,"[12] i.e., traders' advance purchases or sales of stock in anticipation of being locked out of the market by a circuit breaker. This panic trading increases futures market volatility, which in turn affects the stock markets.

[12] The term "magnetic effect" refers to the phenomenon where the price limit acts as a magnet and further pulls the price closer to the limit. Traders, for fear of illiquidity caused by circuit breakers, are eager to protect themselves through aggressive trading, thereby inducing large price variation and heavy trading volume.

E) **Beyond Circuit Breakers: Shock absorbers, speed bumps, and price-limits**

Other measures such as "shock absorbers" or "speed bumps"[13] that are meant to slow down but not halt stock index futures trading could also be adopted in order to slow down futures trading. These rules are less restrictive than circuit breakers as they impose temporary and maximum daily price limits on the price movements at levels that are much narrower than those of circuit breakers. These include opening price limits for stock index futures traded at the Chicago Mercantile Exchange (CME) or the New York Futures Exchange (NYFE), which are set at the equivalent of 40 Dow Jones Industrial Average (DJIA) points, and which are effectively in place only for the first 10 minutes of trading; interim price decline limits are set at 100 DJIA points for stock index futures traded at the CME.

Daily price limits could also be implemented to prevent excessive daily swings. Regulatory authorities should keep pursuing desirable, coordinated measures between the cash and the derivative markets to minimise the effects of potential market disruption, since ultimately, the cash and the derivative markets constitute one market from an economic point of view. Financial soundness can be improved by imposing caps on investor positions.

In emerging economies, imposing caps on FII's trading together with a reporting duty for large holdings can be expected to reduce market volatility due to excessive arbitrage and speculative trading, and enhance transparency in the market.

We believe, however, that the issue with all of these measures is their targeting. A circuit breaker or a trading halt may be well intended, in the sense that it is meant to curb volatility. However, the problem is that from a strictly efficiency-related perspective, it does little to improve efficiency per se. Price limits, for example, may end up boosting volatility instead of curbing it, since they do not allow for instant incorporation of information into prices; once the limit is hit, trading is temporarily suspended and those wishing to trade will have to wait either for a later point in the session or until the day after. This creates a backlog of unfulfilled orders that will take time to unload due to these limits; as these orders are

[13] Shock absorbers or speed bumps are temporary restrictions on the trading of certain stock index futures contracts that become effective following a significant intraday decrease in stock index futures prices.

gradually fulfilled, prices will keep drifting for days,[11] without volatility necessarily subsiding.

Speculator (rational as well as noise) would see a further opportunity in this, since price limits render prices more predictable (as they see it). If one knows that prices do not respond immediately but would take a few days to do so, one may be able to trade profitably on this perceived "momentum" of the market, defeating the very notion of market efficiency, and exacerbating volatility.

V. Conclusion

The series of crises in the 1990s following the October 1987 US market crash and in the early years of the twenty-first century established the idea among regulatory bodies and policymakers that index futures play a key role in the outbreak of such episodes. Our research examines the issue from an academic perspective, juxtaposing the discussion in favour of and against the association of index futures with destabilising outcomes. On the one hand, index futures are found to increase volatility, due to the impact of either rational or noise investors. If rational investors dominate futures trading, the flow of information from the futures to the spot market is expected to rise due to the increase in information-based trading, causing volatility to rise as well. If noise investors dominate futures trading, the concomitant rise in liquidity together with the mispricing resulting from their trades is expected to render futures prices more volatile, in turn increasing volatility in the spot market. On the other hand, extensive evidence suggests that the dominance of rational traders in the futures markets may end up dampening spot volatility, as rational trading renders futures pricing more efficient, with this efficiency carried forward to the spot markets due to the linkages between the spot and the futures markets.

While the issue remains far from being resolved, we would like to point out that a shift in attention on the part of regulators may be necessary in this context. Volatility in itself is not necessarily undesirable, especially if it is the product of improved market efficiency; indeed,

[11] Assume that at day 0, a piece of good news hits the market, and that this signal implies that prices should adjust upwards by 25%. If the price limit in place is ±5%, a crude estimate would state that it would take five consecutive days with upper-limit hits to clear the market (under the unrealistic assumption that no other signal arrives at the market during those five days). If all traders place their buy-orders on day 0, it is unlikely that they will all see their orders being executed on the same day; it is expected that many of these orders will go through during the next few days. The unloading of these buy-orders during these days will create a momentum effect in the market; buy-orders will gradually be executed, causing prices to continue rising.

as the market grows in efficiency, the flow of information in the market will increase, and this is bound to render prices more volatile.

The real issue here is not about tackling volatility but about understanding the causes of volatility that stem from the linkage between the spot and the futures markets and about trying to minimise the effect of these causes that are least conducive to market stability. Noise trading, with its potentially destabilising impact on prices, is one such undesirable cause of volatility. However, regulators need to exercise proper discretion even in this case. Noise traders boost liquidity in the market; therefore, care needs to be taken to ensure that any attempt to draw noise traders away from the futures market does not compromise that market's liquidity. The issue at hand is multifaceted, and its balanced treatment can only be possible if regulators attempt a well-informed identification of the various factors at stake.

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