

Preface

Volatility and risk are of fundamental importance to the finance practitioners among us. Indeed, volatility and risk are practically at the center of all our work. Finance, as a subject, would not exist without them in our business school curriculum, nor in our academic research. Simply put, finance would be indistinguishable from deterministic economics. For that matter, the presence of volatility and risk also bestows significant influence on the finance departments in banks and industrial firms.

By the same token, terms like the following are part of our everyday financial parlance: Risk aversion, risk hedging, risk management, value at risk, risk measurement and risk premium. In our industry, we have high-powered minds, high-powered valuation formulas, high-powered trading algorithms, and high-powered electronic technology to pull it all together. And yet, today's events show us what risk is really about, how at risk our financial markets truly are. The events of the last several months also show us how much we do not know.

Let me contrast our group with an ant, yes, that little red or black creature that can crawl around and annoy us. An ant has actually been classified as one of the dumbest creatures on earth! Yet, collectively, they are very intelligent. Look at how are also highly intelligent. These are the brilliant quants, financial engineers, entrepreneurs, academicians (if I may be so bold), the PhD's in chemistry, physics, and mathematics, and so on and so forth. Finance has attracted many of the brightest minds to its ranks. Still, collectively, as we face these bear market conditions right now, we do not seem so smart. As a group, we have just run into a startling, frightening hole. Are we exactly the opposite of ants? How can we individually be so brilliant and, at the same time, collectively be so very dumb? Where are our intelligent answers and solutions for today's challenging markets?

There is so much about volatility and risk that we do not understand. Even more critically, there is a substantial amount of behavior about volatility and risk that we think we understand but, in truth, do not understand. This kind of ignorance (mistakenly thinking we know our subject) can really come back and bite us.

Risk isn't the only contributor to volatility, and I believe we have lost sight of this. Risk has a well-defined meaning to economists. Risk exists when an outcome can be described as a draw from a probability distribution with known parameters. Flip a fair coin and bet on the outcome: the chance of heads equals 50%; the chance of tails equals 50%. But beyond that we do not know the outcome until after we have flipped the coin. That is risk, clear and simple. In this type of scenario, we will perform a decent job of modeling risk given the probability distributions.

However, along with risk, there is also *uncertainty*. Here we do not know the probability distributions. In fact, we might not even know what all of the outcomes even are. Uncertainty presents a huge challenge. In my opinion, we have not paid sufficient formal attention to uncertainty as a cause of volatility.

Also high on the list of our ignorance is *systemic risk* and uncertainty. In free markets individual firms will fail. Their demise may be understood in the light of Adam Smith's invisible hand, or of Joseph Schumpeter's creative destruction. Systemic risk is another matter. When a systemic breakdown occurs, it is the free market itself that has failed.

High volatility has been with us for over a year now. In my research, I have been focused on this topic for much longer, for many years. Now, if you were to pick one word to describe our markets, what would that word be? My choice would be 'volatility.' So let's go for it. Let's focus on this key property of a financial market. I am not thinking of price fluctuations over lengthy, multi-year periods. I do not have in mind risk and uncertainty about the more distant future. I am thinking of the very appreciable volatility that we experience, day after day, on an intra-day basis. In today's turbulent environment, intra-day volatility is dramatic.

We talk about Wall Street *versus* Main Street. Financial markets are absolutely essential for the smooth functioning of our broad economy. There is, therefore, a huge connect between Wall Street and Main Street. Financial capital enables firms to operate, just as oil enables physical capital, from bikes, to bulldozers, to airplanes, to run. But the financial markets are also fragile. We do not always think about it; and in 'normal' times we do not even see it. But they are fragile. This is especially so in today's high frequency, electronic environment, given the large pools of capital that today can slosh anywhere around the world at a microsecond moment's notice.

Take a look with a magnifying glass at the price movements, the swings that take place intra-day on a daily basis. Price changes of one percent, two

percent or more are commonplace. A one percent daily price move, annualized, translates into 250%. We do not very often see annual swings of this magnitude. In the opening and closing seconds and minutes of trading, intra-day price movements are even more accentuated. How come? What explains it?

Academic evidence of accentuated daily and intra-day price volatility has accumulated over the years. In a paper that I am currently completing with Mike Pagano and Lin Peng, we present evidence on volatility for a large sample of NASDAQ stocks for the year 2005.¹ It was very striking that the three most volatile minutes in a trading day are the two minutes that follow the open, and the final minute that precedes the close. What explains the accentuated intra-day price volatility? Why are the financial markets so fragile? I will briefly address two related items: price discovery and liquidity creation.

I have been focusing on price discovery for many years. Throughout, I have noted its importance in various publications and in my talks. The fact is security prices – the value of shares – are not found in the upstairs offices of the stock analysts. They are discovered in the marketplace.

Share prices are not intrinsic values. Share prices do not follow random walks, and they are not simply and uniquely linked to ‘*the fundamentals.*’ How can they be when, in the face of enormously complex, imprecise, and incomplete information, investors form diverse expectations of future corporate performance? Thus, at any current moment, they evaluate shares differently. And markets are not as informationally efficient as some of my colleagues would like to think. I am not a proponent of the Efficient Markets Hypothesis (or EMH, as we like to say). I suggest that the word ‘efficient’ be replaced. The proper adjective, in my opinion, is ‘humbling.’ The markets are indeed humbling.

Inaccurate price discovery contributes to volatility, and good price discovery is difficult to achieve, especially when some investors’ are influenced by what they see other investors doing. That is when we get information cascades. That is when we get herding. That is when volatility blows up. When these things happen, a market can run into trouble.

Arm-in-arm with price discovery is liquidity creation. I have just completed a paper on this topic with Asani Sarkar and Nick Klage, both from the New York Fed.² In addressing the dynamic process of liquidity creation, we consider something that we call *the sidedness of markets.*

¹ Pagano, M., Peng, L., and Schwartz, R., ‘The Quality of Price Formation at Market Openings and Closings: Evidence from the NASDAQ Stock Market.’

² Klage, N., Sarkar, A. and Schwartz, R., ‘Liquidity Begets Liquidity: Implications for a Dark Pool Environment,’ Institutional Investor’s Guide to Global Liquidity, Winter 2009, pp. 15-20.

Sidedness refers to the extent to which buyers and sellers are both actively present in a market, in roughly equal proportions, in brief periods of time (e.g., five minute intervals).

In previous work, Asani Sarkar and I have found that markets are generally two-sided, and that two-sidedness holds under a wide range of conditions.³ It holds for both NASDAQ and NYSE stocks; at market openings, mid-day, and at the close; on days with news and on days when there is no major news; and for both large orders and small orders. We also observe that buyers and sellers tend to arrive in clusters, that within a day, two-sided trading bursts are commonly interspersed with periods of relative inactivity.

But markets are not always two-sided. At times, liquidity dries up on one side of the market and volatility spikes. Information cascades and herding can take over, and a market can become one-sided. Even if potential buyers and sellers are both in the offing, neither may be making their presence known. And, when prices suddenly head south, one-sidedness is accentuated as buyers simply step aside. Who wants to step up and try to catch the falling knife?

What are the conditions that lead to two-sidedness? What are the factors that trigger trade bursts? What causes a market to be one-sided? Illiquidity is a cause of volatility and its counterpart, liquidity, does not just happen. Liquidity creation is a process. There is a great deal more that we need to learn about the process, about the dynamics of liquidity creation.

As we all know, opacity is needed by the big players. The large traders seek the protection of opacity by either going to a dark pool or, when going to a more transparent limit order book market, by hiding their orders in a stream of retail flow by slicing and dicing them. Nevertheless, there is post-trade reporting for all trades, and information can be gleaned on the general sidedness of markets.

Opacity is one thing; fragmentation is another. Whether liquidity pools are light or dark, fragmentation can disrupt the natural two-sidedness of markets. Can connectivity between the dark pools that exist today in the U.S. be effective? The real concern about the dark pools of today is not that they are dark; it is that connectivity may not be a viable substitute for consolidation.

It is well known that order flow attracts order flow. We have also seen that, over time, the equity markets have generally tended to consolidate. Consolidation and two-sidedness are natural processes for an equity market. They are the main dynamics that underlie liquidity creation. However, modern technology facilitates the increased fragmentation of markets, and it

³ Sarkar, A. and Schwartz, R., 'Market Sidedness: Insights into Motives for Trade Initiation,' *Journal of Finance*, February 2009, pp. 375-423.

supports the possibility of fragile, one-sided markets proliferating. True, advanced technology also facilitates a greater integration of markets, but such liquidity aggregation may prove to be inadequate. The extent to which the natural two-sidedness of markets stays resilient in the face of these developments remains to be seen, and the efficacy of liquidity creation hangs in the balance.

And then there is the temporal dimension of fragmentation. I have, for a long time, been a proponent of electronic call auction trading. I have long urged that calls be included in our predominantly continuous trading environment to open and to close markets. A call is an explicit price discovery mechanism. A call amasses liquidity at specific points in time. A call delivers price improvement for participants who place aggressive limit orders, and this encourages them to, in fact, place aggressive limit orders. The amassing of liquidity and the delivery of price improvement in call auction trading means that a call is more likely to deliver a two-sided market than its continuous market counterpart. Mike Pagano, Lin Peng and I have done some analysis of NASDAQ's new calls, and it appears that the calls have achieved volatility decreases that are both substantial and statistically significant.⁴

Another market structure feature that goes to the heart of the volatility issue is circuit breakers, or, as they are called in Germany, volatility interruptions. In my opinion, volatility interruptions, which are brief, firm-specific trading halts, have some very desirable properties. The interruptions are a check against order placement errors. Most importantly, they also enable the market to switch from continuous trading to call auction trading; in so doing, they sharpen the accuracy of price discovery.

In addition to calls, circuit breakers, and volatility interruptions, there are other market structure solutions to the problem of extreme market turbulence. After the crash of '87, I proposed the establishment of *voluntary* stabilization funds that would buy and sell equity shares according to a strict and well-defined procedure. A fund could be established by a listed company itself and run by a third-party fiduciary. In a falling market, shares of the company's stock would be bought by the fund and, conversely, shares would be sold by the fund in a rising market. The fund's buy and sell orders would be submitted at pre-specified price points, in pre-specified amounts. And, most importantly, these shares would be bought and sold in call auction trading only.

This type of voluntary procedure would disrupt herding, it would bolster the two-sidedness of markets, and it would help to curb the bouts of sharply accentuated volatility that can occur at any time, and which have occurred in

⁴ Pagano, M., Peng, L., and Schwartz, R., 'The Quality of Price Formation at Market Openings and Closings: Evidence from the NASDAQ Stock Market.'

full force since Labor Day 2008. My paper proposing this voluntary procedure was published 20 years ago.⁵ I still support the proposal today.

Dynamism and allocational efficiency are two powerfully positive attributes of a free market. Instability is a free market's Achilles heel. In the last several months we have been hit by tidal waves of volatility. Now fingers are being pointed at many factors, including the housing bubble, greed, hubris, accounting rule changes, the absence of certain short-selling restrictions, management failure, government failure, regulatory failure, and market structure failure. In my opinion, regulatory intervention and market structure, stand out. These two, if properly designed and implemented, could do much to better stabilize our markets in a risky and uncertain world.

In the final analysis, it is not a matter of free markets versus regulated markets. Regulation is indeed needed. But it must be appropriate. A better understanding is required of the issues, concerns, and market failure realities upon which regulations should be based. The sources of government failure must also be taken fully into account. Excessive and ill-structured regulation can be extremely costly to financial markets in particular, and to society at large. I hope that, after the dust has settled, we have achieved a stronger market structure, and a more appropriate regulatory structure. But this much is certain: the financial turbulence of 2008 has provided us with an abundant amount of material to think about.

Robert Schwartz

⁵ Schwartz, R., 'A Proposal to Stabilize Stock Prices,' *Journal of Portfolio Management*, Fall 1988, pp. 4 - 11. Translated into Italian and published in *Rivista Della Borsa*, August 1989. Reprinted in *Journal of Trading*, Volume 4, Number 2, Spring 2009, pp. 50-57.



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