

CHAPTER 2: INTRA-DAY VOLATILITY: FRIEND OR FOE?

Moderator – David Krell, *President and CEO, International Securities Exchange*
Thomas Cardello, *Managing Director, Morgan Stanley*

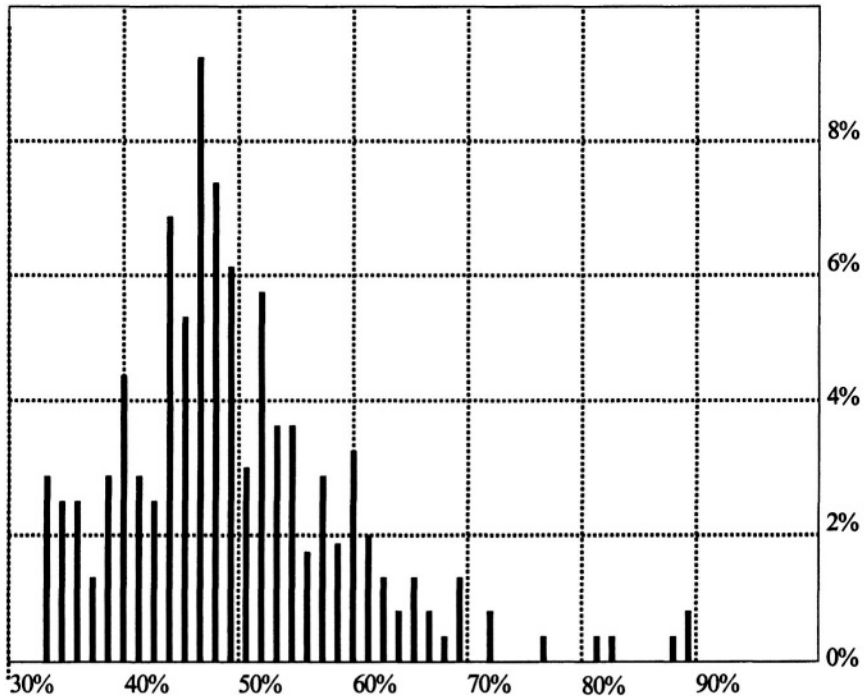
Avner Wolf, *Chairman, Department of Economics and Finance, Zicklin School of Business, Baruch College, CUNY*

DAVID KRELL: We are very fortunate to have two panelists in this session who are experts in the field of volatility. This panel is, therefore, balanced, unlike the previous panel, which consisted mostly of academics. Here we have a 50/50 balance between the practitioner community and the academic community. Thomas Cardello, managing director at Morgan Stanley, is in charge of the automated market-making department. He is also involved in market making in the U.S. as well as overseas. Our other panelist is Professor Avner Wolf, Chairman of the Economics and Finance department here at Baruch College. Both of these individuals have had extensive experience in derivatives trading. It is a pleasure for me to be the moderator of this panel.

First, I would like to meander a little bit beyond the discussion that Bob and I had talked about. Our primary objective on this panel is to talk about intra-day volatility. In the options business, we are very much concerned about volatility in general. If I can present an overview of volatility first, and some definitions of volatility, then we can get to the real topic, the essence of what we would like to talk about this morning – the impact of market volatility on market quality.

In the options business, as you well know, all of the theoretical option pricing models include six basic factors. Five of them are pretty well known. They are the underlying stock price, the exercise price, time to maturity, interest rates and dividends. All five of these factors are known at the outset. The sixth factor is volatility. Volatility is the one that we spend most of our time thinking about, dreaming about, and analyzing.

What do we mean by ‘volatility?’ What do we mean by ‘implied volatility?’ We can use any one of the various models – Black-Scholes¹⁸, the binomial¹⁹, or any of the derivatives thereof – and solve for what we call ‘implied volatility.’ I selected AOL as an example. Look at Exhibit 21.



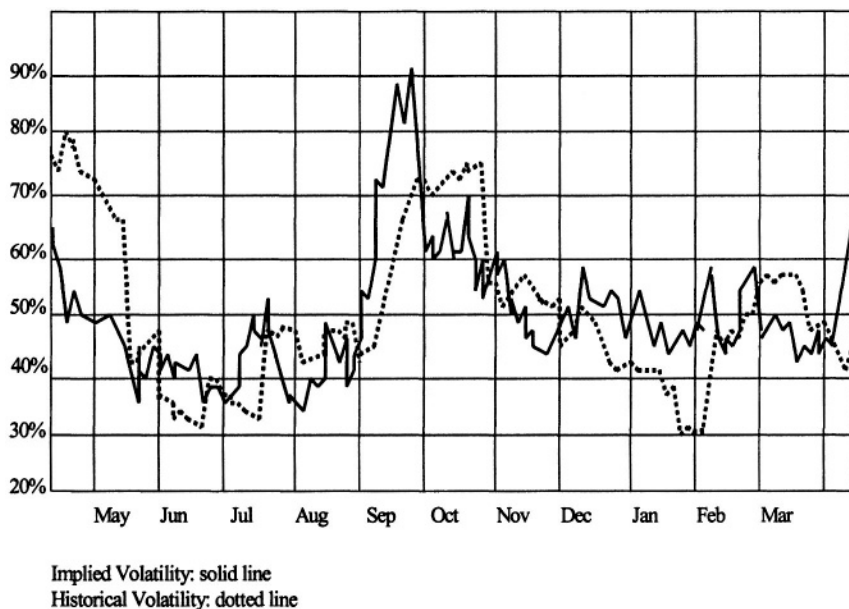
Source: IVolatility.com, IVX Distribution

Exhibit 21. AOL 2001 Implied Volatility Index (30 Day)

¹⁸ A model used to calculate the value of an option, by considering the stock price, strike price and expiration date, risk-free return, and the standard deviation of the stock's return.

¹⁹ An option pricing model in which the Underlying asset can assume one of only two possible, discrete values in the next time period for each value that it can Take on in the preceding time period.

What we see from this histogram is that, in 2001, the 30-day implied volatility from the options price, ranged from about 35% annually to about 90% annually. About 2/3 of the time, volatility was between 40% and 50%, and indeed the highest individual bar is about 45%. This is a pretty tight compression of volatility as we measure it in the options business. We can also look at the implied volatility and compare it to the historical volatility of an underlying stock. Exhibit 22 shows an overlay of both the implied volatility (in this case it is a solid line), and the historical volatility (a dotted line).



Source: IVolatility.com, Historical Volatility and IVindex

Exhibit 22. AOL 2001-02 Historical and Implied Volatility (30 Day)

In 2001-2002, volatility ranged from a low of about 30% to a high of about 90%. It is not surprising that the highs of around 90% occurred in

September 2001.²⁰ The historical volatility deals with what happened in the past. It measures the previous 30 days. The implied volatility, on the other hand, is a forecast of what options traders think volatility will be for the remaining life of the option (in this case, about 30 days). Our measure of historical volatility is the variance of stock price returns over a period of time. Bob, Bob and Deniz discussed this in the previous panel. We frequently use a 20- or 30-day time slot, depending on the life span of the option.

That is an option trader's basic perspective. I would now like to ask our panelists their views. Let me turn first to you, Tom. What does volatility mean to you? Specifically, what does it mean to you as an option trader who needs to make markets in 400 different securities and options at any give point in time?

THOMAS CARDELLO: To provide some perspective, I will first give you a brief overview of the operation we run at Morgan Stanley. We operate as an individual department, which makes markets in options worldwide. We trade hundreds of underlyings and make markets in more than 50,000 derivatives on those underlyings. We are currently handling between 5% and 7% of U.S. national market option volume.

So, from our perspective, what is good volatility and what is bad volatility?

Good volatility is when I am long and the implied volatility is going up. Bad volatility is when I am long and the implied volatility is going down. What is most important vis-à-vis volatility is that there are two aspects to it. One, which the previous panel alluded to, is the microstructure of the underlying asset. There is an implied transaction cost for the underlying that causes volatility in the underlying price. It is influenced by the number of posted shares available and the number of shares the customer wants to buy or sell. The other volatility is the implied volatility that is in the options. In order for us to trade, a good market is one where market impact is not very high. If I see an underlying market with a bid of 1 and an offer of $1\frac{1}{2}$, I need to know whether I can hit that bid or take that offer. So, to me, good volatility versus bad volatility means the efficiency with which I can execute at a price that is displayed in the market.

KRELL: Avner, what does it mean to you?

AVNER WOLF: I would like to elaborate on the issue of implied volatility. Sometimes it seems that we use the term and do not understand what it means. Implied volatility is typically measured with the use of the Black-Scholes option-pricing model. Instead of plugging a volatility

²⁰ The tragic events of September 1, 2001 created fear and uncertainty in the market. Krell picks up this theme later in the session.

estimate into Black-Scholes to find the price of an option, the market price of the option is plugged into the formula and a value for volatility is ‘backed out.’ The value that is backed out is the value that is implied by the Black-Scholes formula, given the market price of the option.

David, I would like to mention something that you alluded to in passing. It is something that I emphasize in my teaching. The volatility that we use in options pricing does not reflect what happened yesterday. Rather, it is the expected standard deviation of a stock’s rate of return between now and the expiration date of the option. Volatility is not something that we can take from history. I gave a presentation in Chicago a number of years ago, and a trader came up to me and proposed that I become his partner if I could come up with a model to forecast and quantify volatility, (laughter) which is very hard.

The title of our session is ‘Volatility: Friend or Foe.’ I would like to mention Bob’s presentation, and try to come up with a definition. It seems to me that good volatility has to do with market information. When new information comes to the market and sparks trading, it generates good volatility. Prices should adjust to new information. But if the volatility were the result of market imperfections and transaction costs, I would call it bad volatility. This is an academician’s definition. But please understand that this academician clearly sympathizes with what you perceive as good and bad volatility from your perspective as a trader.

KRELL: I want to make sure that, when we talk about volatility in the options or derivatives business, it is understood that we are not talking about Beta. Beta is a relative measure of performance. Beta measures the performance of a given stock against a broad based index, such as the S&P 500 or the NYSE composite index. In the options business, we measure the absolute volatility of that underlying component. We only look at the returns and the variance (or standard deviation) of those returns. I think that is considerably different than what you in the academic community, or in the equities world, might think about variability of returns.

I will mention one thing that pertains to the discussion in the previous panel. Paul Bennett talked about different views of market quality. Last year, the SEC requested comment letters pertaining to the proposed rule that Paul Bennett mentioned, Rule 11Ac 1-5. We sent a comment letter to the SEC. It was a tongue-in-cheek comment letter where we created a phantom airline called Fly by Night Airline. Fly by Night had the cheapest fares. However, it only flew between 1 a.m. and 5 a.m. It had a poor safety record. It had a departure and arrival timeliness of 0. It had very poor terminal service. No food or drink was available, and you had to rent your seat belt from them at an additional cost (laughter). Do you want to fly on that kind of an airline?

If the government forced you to go to the cheapest provider, is that the best for you as a consumer? That is the underlying question we are all facing in our businesses today. Is the cheapest cost the best for you at any given point in time? The previous panel talked about price, liquidity, speed, service, transaction costs, transparency and anonymity. These are all components of what is important to certain people at certain points in time. And yet, while price may be an overwhelming desire at some points in time, for large traders it may not be the only component that is important. Just measuring bid-ask spread differentials is not enough. We have to go beyond that price to see what is driven by the desires, the objectives, of users.

I have another question. Does volatility mean revert intra-day? Does it trend?

CARDELLO: Yes, volatility exhibits strong mean reversion.²¹ The question is, how do you exploit that mean reversion? There are two volatilities that exhibit mean reversion – the historical volatility of the underlying object, and the implied volatility. They both seem to mean revert during the day, but the interesting thing is that they by no means move in lock step with each other. If you have noticed, one may revert back to its value earlier in the day. The other might not follow.

KRELL: Avner, any observations?

WOLF: The study described by Bob Wood, Bob Schwartz and Deniz Ozenbas, showed clearly that there is some kind of pattern of short-term volatility, at least intra-day volatility. I am not so sure about long-term volatility. I would agree with you, Tom, that there is some kind of mean reversion structure to volatility. There is also a lot to study with respect to volatility, both historical and implied. How do the two work together in helping us to predict future numbers? I want to emphasize one other issue. The question you asked me earlier, what does volatility tell you, or what does it mean to you? I looked at your numbers in Exhibit 21 for AOL (see page 36). It was what, about 45% for 30 days volatility?

KRELL: Yes.

WOLF: Just think what that means. AOL was trading around 50 for a long time. Fifty percent volatility means that, within one year, the price could go up from 50 to 75, or go down to about 33. That is what volatility tells you on an annual basis. I can use the normal distribution to get an idea about the annual price range of the underlying stock price. So the volatility conveys information that may be used in options as well as in equity trading.

²¹ Mean reversion (reversion back to the mean) refers to reversal behavior. Namely, when a variable deviates from its mean (is either higher or lower), it tends to reverse direction and revert back to its mean (average) value.

It suggests what the average investor thinks about the range of stock prices within a given period (one month, three months, six months, one year, etc).

KRELL: Good. I have some more questions. First, how do you measure volatility?

CARDELLO: How we measure volatility is again two fold. The naïve way is to model the returns generation process of the underlying stock. Volatility would be the second moment of the returns distribution that I am modeling. The other way is to look at the option prices, describe the process that defines an option's price, and back out the implied second moment. Generally, you end up with two different measurements.

The interesting thing is that, as the previous panel said, there is an awful lot of noise in these measures. Getting back to your other question about the reversion of volatility during the day, I again note that there is an awful lot of noise in these measurements. Something as simple as changing the time frame for measurement can give you different answers.

WOLF: If there is a stock or an option that is not traded on an exchange, you cannot use implied volatility. I hope everyone understands this. There is no way to use Black-Scholes to estimate the implied volatility since there is no price that is disseminated throughout the day. You need to do your own calculations and estimation of the volatility. If it is an exchange traded option, where prices are available, I would typically use what the options market tells me the volatility is. This is the easiest way to get information from the market.

KRELL: Over what period of time do you measure volatility? Is it a specific period?

WOLF: When it comes to options, I would typically use 30 days to three months. What is the highest volume of options traded? One-year options? Half-hour options? No. It is typically one-month, two-month, or three-month options. This would be my guideline for the length of time I would use to study volatility.

KRELL: Is volatility inherently good or bad, generically?

WOLF: I will answer with a story. Years ago I attended a conference at Columbia University. There was a big discussion between a Nobel Prize Laureate, Kenneth Arrow, and a yet to be Nobel Prize Winner, Myron Scholes. The topic was, 'Is Volatility Good or Bad, or Do We Need Volatility?' Without volatility, there would be no market. If we lived in a world of certainty, there would be no interest on our part in trading anything. Information would mean nothing. Volatility is necessary for markets. The question once more is, what is bad, and what is good. I gave you my answer before.

KRELL: Tom, any comments?

CARDELLO: I think that volatility, per se, is neither good nor bad. What matters is the costs involved in transacting. You can have two markets that each have a measurable volatility of 40%, and bid-ask spreads of equivalent magnitude. What matters is whether you can actually execute in reasonable size on the bid and offer that is displayed in that market. If I can only trade 200 shares at any one time in one of the markets, and in the other I can trade 100,000 shares at any one time, the second market is going to be much more conducive, not only to higher volumes, but to more orderly markets. In the first market, where you can easily transact only 200 shares at a time, your transaction costs for doing 100,000 are going to be much larger.

ROBERT WOOD²² [From the Floor]: Back to your comment on how you calculate volatility. When you are calculating it as a second moment, you are implicitly assuming that the first moment is stationary.

CARDELLO: No. Why do you say that? I have to ask a question to answer a question (laughter).

WOOD [From the Floor]: Because you are assuming that the first moment is stationary when you are calculating deviations from the mean.

CARDELLO: You have to assume that it is stationary during a certain time period. If I am calculating volatility over a period of, let us say, 30 minutes, yes I have to assume some kind of stationary mean. But I take it during that short time period.

WOOD [From the Floor]: Supposing that, in the 30-minute segment, news arrives that significantly changes the mean expected return for that company over its lifetime. Is that assumption of stationary in the first moment justified?

CARDELLO: No, not in that particular case. But that is just one reason why measuring volatilities is so noisy. In a prior world, I was an experimental physicist. If that was a noisy set of data, I would throw out that particular half-hour period. You have to be very careful about picking periods of data. If you are going to do this analysis, do it when the Federal Reserve does not come out with any news during that half-hour period.

WOOD [From the Floor]: How do you know when you are justified in the assumption that the first moment is stationary?

WOLF: I want to refer to the first study in that area by Fisher Black. It was in 1975. Black had discovered that volatility is not fixed.²³ This is a strong violation of one of the basic assumptions of his model, which, as you may know, got his co-authors Myron Scholes and Robert Merton the Nobel

²² Robert Wood is Distinguished Professor of Finance at the University of Memphis.

²³ See Black, Fisher: "Fact and Fantasy in the Use of Options," *Financial Analysts Journal* (July/August 1975) pp. 36-41.

Prize for options pricing theory. This is a challenge. Most of the models that are currently being used by almost everyone –correct me, David, if I am wrong, even by your exchange – to price options makes the assumption that volatility is fixed. Otherwise, you cannot come up with a closed form formula to price options. Everything else is either too slow, or too inaccurate, or gives results that you cannot interpret.

I do not have a clear answer. I do not even think you can use time in Black-Scholes and find a pattern to the volatility. As you just said, when information comes half an hour later on AOL, or any other company, it may change your initial assumption about the stationarity of the first moment. To a degree, your model is flawed. Nevertheless, we keep using Black-Scholes. I would estimate that 90% of the time market users, with some modification, are still using Black-Scholes in one form or another.

I would like to allude to another issue. What if we have one stock that trades, on average, every 10 seconds, and another that trades, on average, once a minute? The question is, can we use implied volatility for both of them? Once again, implied volatility is taken from options prices. So, if you have a set of stocks with this kind of a delay in trading, you need to look at the underlying stock. You must also know what the liquidity is in the options market. Then ask the question, can implied volatility be used?

Sometimes, if there is no liquidity – and, Tom, correct me if I am wrong – the implied volatility means nothing. Perhaps you have bid and ask quotes. You still do not know what it means, what price to put into your Black-Scholes model for backing out implied volatility.

KRELL: That is right. Option traders take that into account. If you have a stock that is trading within a one point range every 10 or 15 minutes, versus one that is trading every 10 seconds, that will be taken into account in the pricing of that option.

CARDELLO: I have a further thought about the stationarity of the mean. I view any given data sample in segments that are piece-wise stationary. That way, I can make an assumption that the mean will be stationary over small subsets of the overall data sample. In that way, I can get a statistical estimate of the second moment of the distribution. It is the shape of the distribution that you assume is going to be changing. It is going to be varying over longer periods than the mean. The mean itself varies. The idea is that implied volatility is varying more slowly than the actual price.

KRELL: I might point to this chart that is up there (see Exhibit 22 on page 37) to show you how a traumatic event like September 11th effected option pricing, not just for AOL, but for the overall market. Volatility went up for everyone because of the event. You see that dramatically illustrated here. The 90% annualized volatility of AOL in September was indicative of that.

WOOD [From the Floor]: Our tools for measuring volatility are pretty primitive. I wish we could do better.

KRELL: We agree with that.

CARDELLO: Yes, we agree. Absolutely.

PAUL DAVIS²⁴ [From the Floor]: To change the subject just a bit.

KRELL: It is not in the script.

ROBERT SCHWARTZ²⁵ [From the Floor]: That's volatility (laughter).

DAVIS [From the Floor]: We are talking about market quality. I am interested in knowing how the International Securities Exchange is growing, and how Tom's desk plays into that. How has having the ISE available changed what you do?

KRELL: This is a commercial for the ISE (laughter). The ISE is going to be two years old on May 26, 2002. We trade stock options on about 500 individual stocks. Our market share this month is about the highest in our history. Our market share, for the entire market, is about 21%.²⁶

Yesterday was an event for us. It was the first day that we traded more volume than two of our competitors combined. We have been very happy about the acceptance of our market structure, which is a hybrid. The ISE is a screen based, agency-auction market. We do not have a floor. We are fully electronic. We also have dealers like Tom and Morgan Stanley, and others as well, who are required to provide liquidity to our marketplace. With that, I will turn it over to Tom and let him share his experience with us.

CARDELLO: The market share numbers I quoted were volumes exclusively on the ISE. We have significant national market volume by participating primarily on the ISE. We expected, two or three years ago, that the markets in this country are likely to go electronic. Because of that, we put tremendous effort into developing a market making capability for the electronic markets in the U.S. Two years ago, it was a risky decision. More and more, it is turning out to be the right decision.

One of the most valuable things about being able to transact electronically worldwide is the immediacy that electronic trading gives. We

²⁴ Paul Davis is Senior Managing Director at TIAA-CREF Investment Management.

²⁵ Robert Schwartz is Distinguished Professor of Finance at the Zicklin School of Business, Baruch College, CUNY.

²⁶ The ISE, which is the second largest U.S. options exchange, reported strong gains in February 2003, and according to a published release it was the largest U.S. equity options exchange in that month. An analysis of trading volume showed the ISE traded more equity options than any other U.S. options exchange, and its equity options market share was 27%, up 42% from 19% for the same period 12 months earlier. ISE lists 533 options classes.

find that market impact is significantly lower, largely because we do not extend a free option to specialists or to other market participants during the time that elapses between when we first put in an order and when we get that order filled. And now there are enough participants on the ISE and the electronic markets for us to start ramping up our sizes.

Among the many factors which drive the success of a market, especially an electronic market, are the number of participants. Also important is the quality of the participants and the quality of the market makers. We can provide a significant amount of capital. Consequently, the market impact suffered by customers and clients is far less when they come to the electronic market than to an open outcry market. Because of that, we are noticing that our profitability, our market share, and our market volumes are continuing to go up. They are going up by virtue of us providing better markets. I hope that answers your question.

KRELL: Just one more slight commercial. We measure some of our own quality by looking at the spread differential in all of the options we trade. We trade more than 40,000 different series in these 500 different names. Almost 70% of the time we offer the tightest spread. Almost 90% of the time, ISE spreads are equal to or better than the spreads offered in the other four markets. That is another measure of how we think this market will evolve, and why we think that we offer a successful model.

We provide one other thing that I should note. We have intra-market competition among our dealers. Tom is constantly competing with other market makers in our market. This is part of what creates tighter markets and tighter spreads.

CARDELLO: One other comment. There are electronic market structures other than the ISE. U.S. market structure in the future is not necessarily going to be identical to the current ISE market structure. However, I suspect that David will be guiding how the broader U.S. market structure evolves.

WOOD [From the Floor]: What has decimalization done to the noise in volatility that you have talked about?

CARDELLO: Interesting question.

KRELL: Generally, in the options business, we migrated to decimal trading together with the underlying securities moving to decimal trading. However, we did not move into a penny increment environment. Not yet, anyway. In the options business, we still have a minimum tick of 5 cents. This is our minimum increment in trading.

CARDELLO: We trade in both the option and the underlying market. We have observed that decimalization has made the apparent book – the displayed market – more real in the stock market. What is the apparent book? By the apparent book I mean I can trade 100 shares at a 0 spread. I

can trade 500 at a 1-penny spread. I can trade 1,000 at a 2 pennies spread. I can trade 10,000 at a 4 pennies spread and 100,000 at 6 pennies away. Decimalization has just made that a reality. To trade 100 shares you can now trade at a spread of 1 cent or less, and you do not have to get to the level where there is a 10,000-share market which may be 6 cents wide.²⁷ I no longer have to trade 100 shares at the 6-cent spread. I now can trade the 100 shares at the narrowest piece. Consequently, decimalization has apparently narrowed spreads. But it probably has not done that much to the real market in terms of being able to get volume at a given price.

KRELL: We will open the discussion up to other questions. Anthony?

ANTHONY NEUBERGER²⁸ [From the Floor]: I want to return to the relationship between the quality of the underlying market and the quality of the options market. There seems to be some belief that a poor underlying market is characterized by excessive volatility, and that, somehow, this is good for options traders because options traders like volatility. In reality, poor quality in the underlying market makes it much more difficult to arbitrage between the options market and the underlying market. Therefore, the extra volatility which is induced by poor market quality in the underlying presumably translates into poor underlying quality in the options market. I was wondering to what extent this is what you actually observe.

CARDELLO: Two factors come to mind. First, if you have an underlying security that is uncorrelated (or is only weakly correlated) with any other underlying security, then the illiquidity affects the spreads in the options themselves. This is because of the transaction cost inherent in hedging the option. And there is a continued excess transaction cost associated with the dynamic synthesis of the option. If you are going to synthesize an option – if you are long or short an option – you can hedge that option by trading stock against it, according to a prearranged trading strategy in the Black-Scholes model. On the other hand, let there be a high correlation between an underlying security that has very low liquidity and another security that has very high liquidity. For instance, assume that some low liquidity stock has a high correlation to some high liquidity stock such

²⁷ Decimal pricing on the NYSE, for instance, has narrowed spreads. On the negative side, academic studies show that the depth of the market – the number of shares offered at a specific price – has decreased sharply from the levels in the pre-decimal market. The reason cited is that investors have more pricing options than under fractional pricing. Decimals have made it cheaper to trade in small quantities of stock but harder to execute much larger orders.

²⁸ Anthony Neuberger is Associate Dean of the Full-time Masters in Finance Programme at London Business School.

as General Electric. Then I can effectively hedge the option using the high liquidity stock. Because it is liquid, it enables me to put on the position with lower transaction costs. So the answer to your question is, yes-no (laughter).

WOLF: The answer, in my view, is very clear. If there is no liquidity in the underlying stock, there is an accentuated volatility for the underlying stock. This is an increased volatility for the options trader, and volatility is very important for options trading. However, as Tom just said, people do not trade options just for the sake of trading and speculating. Some participants trade to hedge. You cannot establish the hedge very easily in an illiquid market. In that respect, what you alluded to as bad volatility won't help the options market at all.

WOOD [From the Floor]: Tom, are you saying that your hedging costs have not been reduced by decimalization?

CARDELLO: No, I am saying that the apparent liquidity has not changed. But if I trade 1000 contracts and my hedge ratio is 20%, I really only need to hedge a certain amount of stock. I will be able to hedge that stock at a better price if it is within the apparent market.

I have to translate that into English. If I trade one option contract on 100 shares, the underlying amount that I have to hedge is 20 shares. If, in the old regime prior to decimalization, that market was 1000 up 6 cents wide, I will be better off now because I can probably get the 20 shares off at 1 penny. But if I trade 50 times that amount, I am no better off because my liquidity is not at a penny wide. It is still at 6 cents.

WOOD [From the Floor]: Given the size range that you are in, can you provide us with a feel for any change that decimalization has had in your aggregate trading cost?

CARDELLO: Our operation started about two years ago. When we started, we were trading 10 lots. In those days, when decimalization was coming in, it made a difference. But nowadays, with the sizes that we trade, we are typically several thousand up on liquid names, on individual posting, and maybe even five times that on facilitation type orders.²⁹ So decimalization helps to the extent that it brings in more liquidity, but I would not say that it makes much of an impact given the sizes we are trading now.

KRELL: We have time for one more question.

NARI JOTE³⁰ [From the Floor]: Someone had said that, if there was no volatility, there would be no stock market. Is there any relationship between volatility, transaction costs, and the cultural behavior of the individuals? I

²⁹ A facilitation type order occurs when a broker dealer takes some fraction of the "other side" on an order to trade a number of contracts at a certain price.

³⁰ Nari Jote is Management Consultant and Global Business Coordinator at Jote & Associates.

have worked in India, in the U.K., and in this country. I see that people have a different behavioral sense when it comes to volatility. What do you correlate that with?

I also have a second question. What part does an Enron type disaster play in volatility?

KRELL: I didn't really understand the first question. Let's move to the second one.

JOTE [From the Floor]: OK.

KRELL: Does anyone wish to comment on the changing volatility in an Enron-type situation? How is that taken into account in options pricing?

CARDELLO: Obviously, volatility goes up immediately. The interesting thing about something like an Enron is that, since the news did not all come in one sudden instant, and since the price did not instantaneously go to its lowest level within 20 minutes (it took a couple of days), and because there was a liquid underlying market, we were able to continue making markets in Enron even though the option volatilities went way up. The implied skew of the option – the expectation that the stock price would decline instead of rise – was also immediately changed. We saw that we were able to conduct orderly market making activity in Enron while the stock was open on the stock exchange. The options prices went way up. This was largely because there was liquidity in the underlying stock during that time, and the price movement did not occur all at once. Contrast this with a case where a merger or an acquisition is announced and, all of a sudden, the stock immediately goes up 10 points and stays there forever. That is an un-hedgable event.

KRELL: I believe your first question was...

JOTE [From the Floor]: My first question was cultural. Isn't it a cultural factor that different countries have different volatility factors?

CARDELLO: A quick answer to that is to contrast the U.S. with Hong Kong. There is a very large speculative interest in Hong Kong. You see high volatility markets. You do not see very high liquidity except in some of the indices. And, in the U.S., because you do not have that level of speculative mentality, you have other institutional players in there. Consequently, the U.S. markets are not as 'choppy.'

KRELL: The other issue pertains to market structure. In India, for example, until recently, you had a product called 'badla.' Basically, badla was a way of buying and selling stock without paying for it. It is called 'kiting' in the U.S., and it was outlawed after the Crash of 1929 because it was cited as a contributing factor. But in India, it was legal and prevalent, extremely prevalent, until it was outlawed within the last year or eighteen months. Now I think it is much more likely that you will get a situation where you have true derivatives trading in India. But that was a way of

trading a derivative without trading on an organized exchange. Badla was basically a bet between two individuals on the price of the underlying stock. It was like a swap. And then the payments would be equalized. Am I correct on that?³¹

JOTE [From the Floor]: That is true. And it is changing fast with the global economy integrating together.

WOLF: In academia, and I believe also in practice, we find that when the market is down, volatility is up, and visa versa. Right now, we are going through a different phase. The market is down and volatility is down. Putting this together, how would this effect the trading of options based on what we see right now?

KRELL: We are recently undergoing a consolidation in the options industry. You can read almost every week about the prices of memberships at various exchanges, and about various trading groups consolidating. We are in a unique situation. The competition between and among the markets is so intense, that spreads have narrowed to their tightest levels in options trading in a decade. And volatility is at an all time low. That is not a good combination to have from an options trading perspective. It is all three plagues happening at the same time: industry consolidation, narrower

³¹ Kiting was prevalent in the U.S. prior to 1929, according to financial historians. It had an unsavory connotation because kiting was used to prop up “bucket shops.” It allowed speculators to buy and sell stocks without putting up any cash. For example, an investor could buy a stock through a broker dealer for \$10 without putting up the money and then, an hour later in a rising market, sell the stock for \$11 dollars and pocket the difference of \$1.

spreads and volatilities at new lows.³² As a result, we are undergoing tough trading times from a trader's perspective. From the customer's perspective, it is terrific, but from the trading perspective it is very, very difficult.

I would like to thank our panelists, Tom and Avner, for a terrific job. Thank you all very much.

³² The larger, more capital-intensive firms in the U.S. drive industry consolidation of small options specialist firms. The multiple listing of stock options on various exchanges has hurt these small firms. Consequently, there are fewer traders on the floors and demand for seats has softened in part because of this trend. Decimal pricing has also hurt floor traders. In early 2003, there were five U.S. options exchanges and a sixth pending a launch in mid-year. These six are the Chicago Board Options Exchange, the International Securities Exchange, the American Stock Exchange, the Philadelphia Stock Exchange, the Pacific Exchange and finally the Boston Options Exchange, which was expected to become the latest.



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