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Market Integrity

Do Our Equity Markets Pass the Test?

Springer

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Preface

The Low Down on High Intraday Volatility

Opening Remarks

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"What is the meaning of integrity" is the focus of today's conference. We certainly know what integrity implies, but actually defining the word is not an easy matter. I Googled and soon learned that integrity has to do with consistency as well as truthfulness and accuracy. I will accept that from Google and will also add reliability just for good measure.

To start, I would like to focus on accuracy. So, where, you are asking, am I heading? Straight to price discovery, something that I have previously talked about here at our annual Baruch conferences. Today, we have two panels focused on price discovery. The first, from the perspective of the exchanges, is moderated by Justin Schack; and the second, moderated by Ian Domowitz, is from the perspective of the customers. Price discovery is an excellent lead into intraday volatility, something I also wish to focus on today in my introductory remarks.

I emphasized the importance of good price discovery in my opening remarks for the 2011 conference, "The Economic Function of a Stock Exchange." While editing my remarks for the 2011 conference book published by Springer,[1] I saw the basis of a strong and persuasive paper, so I invited my doctoral student, Nazli Sila Alan, to co-author it with me. Our efforts have resulted in a paper, Price Discovery: The

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[1] Springer, Part of Springer Science+Business Media.

Economic Function of a Stock Exchange, published in the Fall 2013 issue of the *Journal of Portfolio Management (JPM)*.[2]

Price discovery, in my opinion, has received insufficient attention. How come? It is complex and not well understood. More importantly, it is very hard to measure. How might one assess the accuracy of price discovery vis-à-vis underlying equilibrium values, which is something we love to talk about in our economics courses? Where do the aggregate buy and sell curves cross to describe a broad market's desire to hold shares in equity trading? God only knows. For us mortals, equilibrium prices are simply not observable.

Can a benchmark be used to infer the inaccuracy of price discovery? Yes, this is possible. To obtain this benchmark, let me introduce the concept of price discovery noise. Price discovery noise, which refers to the deviations of actual prices from equilibrium values, is manifest in an accentuation of intraday price volatility. Intraday volatility is, of course, accentuated, as we all know, by spreads and market impact. But I submit that the noise is largely attributable to prices dynamically searching for, and not easily attaining, equilibrium values. From the data we accessed, it certainly appears to be the case in the opening moments of trading and for the first half hour of trading. The main reason for the accentuated volatility which we and many others have observed in the data (and many of you have observed in reality) comes not from spreads, not from market impact, but from inaccuracies in price discovery. To see this, let's look at some stats from my JPM paper with Sila.

To obtain a volatility measure on a daily basis, we assess high/low spreads expressed as a percent. In doing so, we have sorted all of the US stocks in each and every trading day in 2011, according to their opening volatility, into 20 equally sized groups for each individual stock. Today, I want to focus on a subset of these stocks: Just the big ones, the Dow Jones Industrial Average (DJIA) stocks between $30 and $100 in prices. For each of these groups as shown in Table 1, we can have several Dow stocks. We simply selected the highest Dow stock in each group, and that stock is identified on the left. Our purpose was to find the more striking situations, the more volatile situations. A large number is in the eyes of the beholder. Our lowest observation was 0.33% on April 6, 2011, in Johnson & Johnson (JNC). The highest was Disney (DIS). We were looking for special cases like this.

Consider Disney (DIS) in Table 1, on August 10, with a volatility of 7.61% observed for Disney. This number is the percentage difference between the high price in that half hour and the low price at which Disney traded. So 7.61% means that, within a half-hour period, somebody bought at a price 7.61% greater than somebody else paid for the stock. Somebody sold higher and somebody sold lower. Is that integrity or hypocrisy? What's going on?

Table 1 Opening volatility selected Dow stocks

Company name (ticker)	Date	Avg price	Hi-Lo	Spread	Volatility (%)	Adjusted volatility (%)	Group[a]
Johnson & Johnson (JNJ)	04/06/11	$59.82	$0.20	$0.01	0.33	0.31	5
Boeing (BA)	06/29/11	$72.34	$0.38	$0.03	0.53	0.49	6
Home Depot (HD)	04/20/11	$38.34	$0.25	$0.01	0.65	0.62	7
Merck (MRK)	09/27/11	$32.06	$0.25	$0.01	0.78	0.74	8
Travelers Companies (TRV)	08/04/11	$53.32	$0.48	$0.02	0.90	0.86	9
Exxon Mobil (XOM)	05/26/11	$81.92	$0.82	$0.01	1.00	0.99	10
Procter & Gamble (PG)	04/12/11	$62.52	$0.71	$0.01	1.14	1.12	11
McDonalds (MCD)	10/05/11	$86.19	$1.12	$0.04	1.30	1.26	12
Walmart (WMT)	01/20/11	$55.66	$0.80	$0.01	1.44	1.41	13
American Express (AXP)	09/26/11	$46.59	$0.77	$0.03	1.65	1.60	14
United Technologies (UTX)	02/24/11	$82.74	$1.53	$0.03	1.85	1.81	15
Unitedhealth Group (UNH)	12/08/11	$49.25	$1.05	$0.02	2.13	2.08	16
Verizon (VZ)	08/01/11	$35.80	$0.89	$0.01	2.49	2.46	17
Du Pont (DD)	08/05/11	$47.88	$1.45	$0.02	3.03	2.99	18
Jpmorgan Chase (JPM)	08/25/11	$37.69	$1.57	$0.01	4.17	4.14	19
Disney (DIS)	08/10/11	$30.34	$2.31	$0.02	7.61	7.55	20

[a]There are no Dow stock observations in the first four groups, therefore our table starts from Group 5

There was no news announcement at the time. We plotted the price movements over this half-hour period. It was indeed an uncertain time in the market. Markets were profoundly rattled by the European debt crisis. Could that explain it? Not so easily, Disney opened at the high price is what happened. How accurate was that price? How accurately did that price reflect the underlying propensities of investors to hold shares? Was the opening price produced by the intersection of a buy curve – call it like a demand curve, and a sell curve – call it like a supply curve? Disney's opening price was an equilibrium price that intersection would have delivered. But it is not easy to find an equilibrium price when investors have different opinions about share values.

Much of the various works by Sila and I and some others of us here is in the context of investors having what we call "divergent expectations." That conflicts with a lot of what's taught in standard academic courses and its opposite homogenous expectations, underlies many academic models (e.g., the capital asset pricing model). If investors have homogeneous expectations, then you don't need a marketplace to

Table 2 Price paths: DIS & SPY on 8/10/11 9:30AM–10:00AM
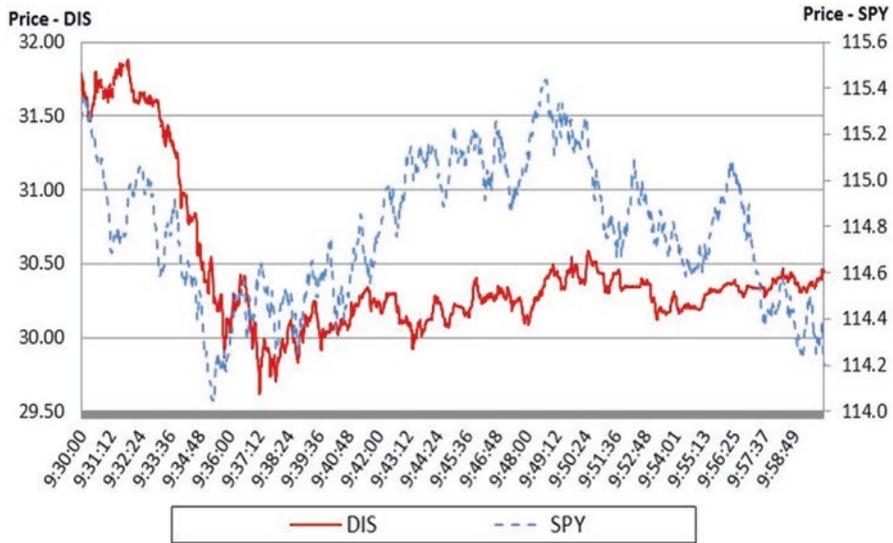
find the value of shares of a stock. We just know what it is. The research analysts know what it is. But when they have divergent expectations, this knowledge about an equilibrium price disappears.

In times of stress such as in August of 2011 with the European debt crisis flaring, we certainly expect that expectations were more diverse across investors, and so price discovery was harder to determine. Now look at Table 2. The red line is Disney, and the dotted darker line is SPDR S&P 500 ETF (SPY), so you can relate to what else is going on in the market. They're fairly correlated. Disney opened too high, then it went higher, and then it goes down. Why? What accounts for it? Is it because something happened in those minutes, because the initial price was not a good price, or because it lacked integrity? I think it's the latter. This is in my paper with Sila, and it's an important way of looking at things. Now let's take the full set of Dow stocks. Let's get away from Disney and look at the opening half hour in each stock day. Every day we look at every stock and get its high/low. In Table 3, we group the stocks into volatility groups. The same stock can be in different groups on different days. I didn't say it with the previous slide, but I'll say it here because it's the same thing. Why do the groups begin at group 5 down to group 20? Because no Dow stocks were in groups 1 through 4, they all have higher volatility.

What we're looking at is this: One stock can be in different groups on different days, it doesn't matter. For each group, we show the average high/low, the minimum and maximum volatilities, and the number (*N*) of observations in a group. What's interesting is that 43% of the observations fall into the higher groups, 11 through 19, the percentage is pretty low for group 20. Lo and behold (no pun intended), volatil-

Table 3 DOW stocks: opening volatility by Vol Group, 252 trading days in 2011

Group[a]	Mean (%)	Median (%)	Min (%)	Max (%)	N[b]	% N (%)
5	0.28	0.28	0.16	0.31	77	1.02
6	0.42	0.42	0.32	0.49	607	8.03
7	0.56	0.56	0.49	0.62	939	12.42
8	0.68	0.68	0.62	0.74	1032	13.65
9	0.80	0.80	0.75	0.86	854	11.30
10	0.92	0.92	0.87	0.99	780	10.32
11	1.05	1.05	0.99	1.12	754	9.97
12	1.18	1.18	1.12	1.26	600	7.94
13	1.33	1.33	1.26	1.42	503	6.65
14	1.50	1.49	1.42	1.60	412	5.45
15	1.70	1.70	1.60	1.81	294	3.89
16	1.94	1.93	1.81	2.09	259	3.43
17	2.25	2.24	2.09	2.46	197	2.61
18	2.71	2.68	2.46	3.02	148	1.96
19	3.49	3.40	3.03	4.14	78	1.03
20	5.56	4.86	4.19	8.89	26	0.34

[a]There are no Dow stock observations in the first four groups, therefore our table starts from Group 5
[b]Total number of observations is 7560 (30 stocks × 252 trading days)

Table 4 Opening volatility: NYSE & NASDAQ stocks

ity for group 20 is huge! For group 11, the volatility was 1.05%, for 19 it was 3.49%. That's the percentage difference between the high and the low price in the first half hour. It's fairly representative of this data. I don't know what you are thinking, sitting here, looking at it, and I hope our conference today delves into related issues during the day. But it seems pretty striking to me. And that was the purpose of our paper to find out. Gosh, people *talk* about volatility, about it being high and inflated. Sila and I wanted to obtain a succinct read on it.

In Table 4, I will present what has happened over time. Have our markets improved according to this measure of market quality? We look at NASDAQ, and we look at the NYSE – and this is fairly striking to me. Now, the conservative thing to say about NYSE volatility is that it starts a good deal lower, and that it certainly has not decreased. Nice if it had. NASDAQ, for the most part, has come down. There have been big swings on NASDAQ, but it has otherwise dropped down, and the NYSE has risen. What could account for this? I will suggest one factor: fragmentation. We've been looking at this. Sila has looked, and fragmentation really seems to be a cause of what I have described. Over time the NYSE market, as we all know, has fragmented. It's gone from over 80% of market share of trading in its own listed stocks to under 30% by some measures under 30%, and it is now in the 20% range. HFT has affected NASDAQ as well as the NYSE, and we have somewhat more direct evidence elsewhere. But it's not so easy to pull together all the relevant evidence. Enough said. I do know one thing, it gives me great pleasure to welcome you here today. Let's discuss all of this.

List of Participants

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