

21 Week 8 Trading and crisis

21.1 Brandt and Kavajecz Q&A

Background.

1. With the advent of order flow data, people found that order flow explains price changes. Maybe “selling” really does cause prices to go down. Heresy!

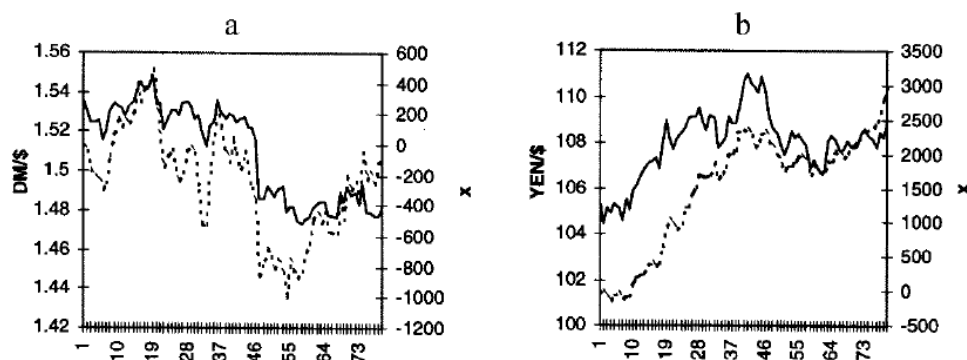


FIG. 1.—Four months of exchange rates (solid) and cumulative order flow (dashed), May 1–August 31, 1996: *a*, deutsche mark/dollar; *b*, yen/dollar.

Source: Evans and Lyons, JPE.

2. The standard theory of finance:
 - (a) Prices change with no volume. The uninformed refuse to play. Story 1: They buy and sell only the entire index, so you can't earn alpha off them. Story 2: The Groucho Marx theory. If you want to buy from me, you must know something I don't. Either way, if you have information, you just bid up the price until it reflects your information, with no trading volume.
 - (b) The Grossman-Stiglitz “markets can't be efficient” theorem: if markets are perfectly efficient, nobody would bother to find information in the first place! So, there must be enough trading and inefficiency to compensate traders for time and information gathering costs. But how?
 - (c) The standard model has “informed traders” and “liquidity traders.” “Dealers” set a bid-ask spread to take advantage of the “liquidity traders” and not get hurt too bad by the “informed traders.”
3. The challenger: “price pressure,” “downward sloping demand curves,” etc. If you dump shares on the market, the price will go down. If there is more “demand” than “supply” price can increase with no change expected present value of dividends.
4. Some possibilities for the ways that price and volume can be correlated:
 - (a) A macro announcement (The Fed); prices change, no immediate volume. Volume follows as people rebalance. (p.2624 top)

- (b) “Price discovery.” People with ideas trade, markets move. (p. 2624.)
 - (c) “Price impact,” “Price pressure. ” “Downward sloping demand” in any given market.
 - (d) “Inventory” is one version. Limited number of dealers, who must bear risk while waiting for buyers to arrive. To absorb a large inventory, price must go down so expected return can rise.
5. Central point. Yes, order flow is *correlated* with price changes but B&K show evidence for “price discovery” not “selling pressure.”

Questions and answers

1. How do B&K measure “orderflow?” You see a trade; how do you know if it’s a “buy” or a “sell?” (“The market went up on a wave of buying” is a classic *fallacy* – for every buy, someone sold!)

A: p. 2627 pp2, 2628 pp2, the data do include “initiator.”
2. See Figure 2 p. 2629 for timing of variables
3. Table IV: *Central table*.
 - (a) ***What does the number -0.72 in the top left corner of table IV mean? (This is a question about units – if x moves by what, what happens to y)

A: see 2635, bottom. The units seem to be basis points of yield on orderflow relative to standard deviation. Thus, a one standard deviation move in 0-6 months orderflow means -0.72 bp movement in yield. He says this is a lot (?)
 - (b) Is the regression in Table IV a forecasting regression or does it document a contemporaneous correlation?

A: contemporaneous. The issue is how much does price change with orderflow.
 - (c) (Overall, how much of the unexpected daily change in yields is accounted for (notice I’m not saying “caused by”!) orderflow?)

A: R^2 values around 0.15 in Table IV. Note B&K overly complicate things by forecasting the level of yields with lagged yields, and then doing this in levels. They should have just looked at changes in yield, which I suspect would give exactly the same answer.
 - (d) ***There is a pattern in the coefficients of Table IV – which orderflows are most important for explaining each kind of yield change?

A: 2637, top. It’s own orderflow, and also the 2-5 year flow. Brandt interprets this as a “bellweather” effect of the 5 year bond. Notice the same sort of story as I was telling in “Stocks as money.” There is one particular security (Palm, On the run bonds, etc.) where information trading and price discovery happens; that news leaks out to related quieter securities. “bellweather security” page 2637.
4. (Is the orderflow effect stronger or weaker on days with big macro announcements? Why do we care?)

A: Weaker, see “all days adj R2” and discussion 2637. On macro announcement you get big price changes with no trading. (I.e., the way it’s “supposed” to work.)

5. (How well would you do forecasting yield changes with one “order flow in all maturities” variable, rather than separate order flows?)
 A: Last column; TIV 2636. Almost as well. The bond-specific order flows don’t really matter all that much.
6. What is the “inventory premium” view of the correlation between orders and price changes?
 A: p. 2640. For traders to stick around and absorb (say) big sales, the big sales must depress price a bit, so that the traders make a bit of money.
7. In one sentence each, distinguish the “price discovery,” “price impact” and “inventory” views of the correlation between order flow and price change
 A: Price discovery: A piece of news arrives to informed traders. They buy, there is volume, and the price goes up to where it was going anyway. Price impact: A bunch of morons buys stocks. Demand curves aren’t flat so their price impact sends stocks up. Inventory: A bit more sophisticated, thinks about the supply end. As above. Inventory can explain why flow of one maturity affects prices of another maturity. One way to put the issue, is the “buying demand” that changes price “informed” or is it “uninformed?”
8. (The most important question) Overall, what three pieces of evidence lead B&K to a “price discovery” view of the impact of order flow on prices, rather than the simpler view that “selling pressure does reduce prices after all” or there is an “inventory premium?” (Hint: Tables IV VI and VII matter here as well as B&Ks discussion starting 2640.)
 A: 2640-2641.
- (a) The fact that *other* bond’s order flow (2-5) so significantly affects *this* bond’s price in Table IV.
 - (b) The fact that numbers in T IV are larger for liquid on the run rather than illiquid off the run. Inventory premiums should be higher in illiquid markets. (Note: “On the run” = recently issued, lots of volume, low bid ask. “Off the run” are older, e.g. last year’s 5 year now a 4 year, mostly parked in desk drawers, not much volume, high bid-ask, typically higher yield)
 - (c) More strongly in VI, off the run bond yields respond to *on* the run order flow.
 - (d) VII no response to one-day lagged – no “recovery” following a “depressed” price (as Carhart found for the bounce back after mutual fund last minute sales.) i.e. The fact that orderflow imbalances are associated with *permanent* rather than temporary price changes.
9. p. 2641 “price discovery where substitutes are present tends to take place in the market that is most liquid.” I.e. Palm vs. 3com
10. A mild criticism. The inventory view would note that there is a lot of correlation between yield changes. So, if you buy a lot of 1 year bonds, you are also exposed to the risk that 5 year bonds change and vice versa. The stylized version I talked about in class implicitly assumes that assets are uncorrelated.
11. Implications.
- (a) Reports from the real world: Trading matters a lot! Trading costs and price impact matter a lot (DFA cases in Investments class.)

- (b) In the standard view, there should be no price impact if you can convince people you are not informed. For example, Bill Gates regularly scheduled stocks sales. Is this true?

21.2 Hasbroukh and Saar, “Low-Latency Trading”

Read only up to p. 17 (section IV). I didn’t get much out of the regressions!

Show figure 1 from old version of the paper too

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“Latency” p. 1 the time it takes to learn about an event (e.g. a change in bid) generate a response, and have the exchange act on that response. NB: human reactions are around 200 ms

p.5. Top. Nasdaq structure: electronic limit orders. “Marketable” means e.g. a buy order above existing asks. You can have “non-displayed” orders, but there is no more mention of these. “*Execution priority follows price, visibility and time.*” That is very important, I think, in driving speed, which the Budish et al paper really goes after.

p. 5 A “message” is a new order, a cancellation, execution of displayed or non-displayed order.

p. 7, old paper. remarkably slow on average: 2.3 messages per second. “the average belies the intensely episodic nature of the activity”

p.8. *Important* description of agency algorithms.

p. 9 and Figure 1. On-second periodicity *Look at this astonishing figure!* Apparently many algorithms check once per second, and everyone’s computer time is set to within milliseconds of each other.

p. 9 We believe that these peaks are indicative of agency algorithms that simply check market conditions and execution status every second (or minute),...

Will it last?

.The clustering of agency algorithms means that the provision of liquidity by proprietary algorithms or by one investor to another is higher at these times, and hence conceivably helps agency algorithms execute their orders by increasing available liquidity. As such, agency algorithms would have little incentive to change, making these patterns we identify in the data persist over time.

It is also possible, however, that the major players in the industry that designs and implements agency algorithms were unaware of the periodicity prior to our research. If this is indeed the case, and the predictability of buy-side order flow is considered undesirable for various reasons, our findings could lead to changes in the design of agency algorithms that would eliminate such periodicities in the future

Is this an accident or “even-second liquidity?” Is it like open/close or daylight liquidity? Or an accident that will soon disappear – someone told a programmer to check once per second, and he programs the computer to check *exactly* once per second?

“Proprietary algorithms” “meant to profit from the trading environment” *A small set of traders.*
(17) *JC note: it’s a zero sum game among 17 traders. They can’t all be making money!*

p. 11, *Figure 2.* responses to quote improvement/decline. 2-3 ms peaks. bottom of p. 10, these responses must be computers. An Important insight: By moving in sub-200 ms range you know the trader on the other side is a computer. So you can game each other’s algorithms with fast trading. I always wondered what these 10 ms quotes were up to.

Figure 2 p. 11. We plot separately the conditional hazard rates... The figure suggests that the time it takes for some low-latency traders to observe a market event, process the information, and act on it is indeed very short.

p. 11-12 Table 2: amazing “strategic runs” of limit orders placed and immediately canceled

We highlight in gray some of the orders and cancellations in the table to make it easier to see what appear to be two algorithms that are engaged in strategic behavior attempting to position themselves at the top of the book..

The underlying logic behind each algorithm that generates such “strategic runs” of messages is difficult to reverse engineer....

- The rapid fire placing and canceling of orders is one of the big puzzles in this market.
- *Algorithms that submit and cancel in 10ms are trolling for computers, not humans.*
- runs end in execution 30% of the time, much more than 7% for static limit orders and most often by hitting an active marketable order
- Algorithms often want to keep their place in the limit order book. So, if one guy changes his order, everybody else reacts quickly.

p. 12, “social benefit” “liquidity provision” vs. “liquidity subtraction”

21.3 Krilenko Kyle Samadi Tazun Questions and answers

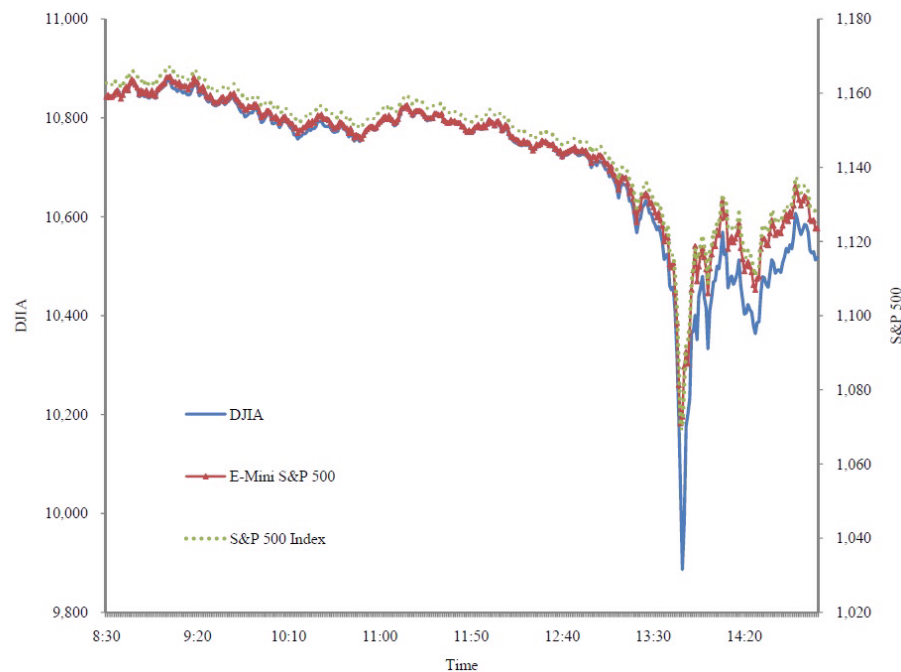
- This goes on and on a bit. I found myself skimming the regressions but looking for the nuggets of summary.
 - This event is the single greatest obvious “inefficiency” – price not equal expected discounted cashflows – I know of, so worth studying! Buying in this interval was the high frequency trading buying opportunity of a lifetime. How did they (us) miss it!?
 - Events: Figure 1. Note it was not limited to the E-mini contract, and was well arbitrated even to cash markets (indices) Volume, Figure 2. Lots of volume – markets did not shut down.
 - Questions
1. p.9 What according to Krilenko et al was the major spark? What event at least coincided with the end of the crash and quick recovery?
(exhibit A in “a stop loss order is not a put option!”).

2. p. 16-19, Figure 4-5 and 6-7. Looking at profits together with net positions, do HFTs and intermediaries seem to be helping or hurting? (Note: to me the words and the figures do not match up. Get ready to discuss in class.)
3. p.20, Figure 10-11. How does the behavior of “opportunistic traders” contrast with those of HFT and intermediaries?
4. p.21. In their interpretation of regressions, how to Krilenko et al characterize HFT strategies? (p.35 discussion is their summary story. Connecting this to evidence is harder. The big question: do HFTs act as “market makers” and “increase liquidity?”

Krilenko et al notes:

- p.9 I’m interested that the 5 minute trading stop seemed to put an end to it. Maybe trading halts aren’t such a bad thing?
- p. 12. The definition of “aggressive” whether the buy or sell initiated the transaction
- p. 13. (Definition of trader types. Intermediaries, High Frequency, Fundamental, Small and Opportunistic. JC: Intermediaries and HFT are defined that they don’t end up with substantial positions, so the fact they don’t “provide liquidity ” may be hard wired? p. 14, and Figure 3. How exactly is the figure constructed? I’m not sure.)
- p. 15 (“Aggressive” and “take vs. provide liquidity.” “Aggressive” means the one who initiated the trade. I think “aggressive” by definition means “remove liquidity”)
- p. 17 (*Figure 4.* HFT do not accumulate holdings as seen on previous days. Since HFT by definition do not accumulate holdings, this must be about the previous days.)
- p. 18 top, and figure 4/5. Claim that HFT and Intermediaries buy initially, but then stop, and sell, contributing to price decline. The evidence is a bit hard to see in the figures?
- p. 18-19. and Figures 6, 7. Profits are much clearer. Both seem to be making money on the way down, thus ahead of price decline. But both must have turned positive before the crash and then got hit? The words and pictures again don’t seem to match. Both intermediaries and HFT have long positions in the crash, lose money, then make it all back again. They seem pretty static. Their long positions may have helped overall, but they don’t aggressively buy a lot more at the bottom and make a killing by the end of the day. This is not what the words say.
- p. 20-21, Figures 10-11 opportunistic seem to be making money - selling when prices go down, buying when they go up – but not “providing liquidity” Again, I can’t match the words well
- p. 21 -22 interpretation of the monster regression of Table IV. HFT and Intermediaries seem to follow “momentum” and then “reversal” – in seconds, not years!
- p. 35 discussion. This is maybe the clearest part of the paper. You need “fundamental buyers” to step in to match a large ‘fundamental seller.’ HFTs provide liquidity only for a few seconds, then start piling in on price trends.

- Question: What about all the other markets? This seems like a story to explain a huge honking arbitrage between E mini, other indices and actual stocks. But if Figure 1 is right all stocks went down!
- Another story I've heard. As you know, "being a market maker" is the same thing as "writing straddles" i.e. short volatility. Many trading programs try to "synthesize free put options with stop-loss orders" i.e. they leave when volatility is high. Thus liquidity dries up right when you need it most – and *these fancy programs missed the buying opportunity of a lifetime!*
- Important bottom lines: More trading doesn't necessarily mean "more liquidity"
- See optional reading "art in high frequency markets"



21.4 Budish, Cramton and Shim

1. How correlated are changes in the E-mini S&P 500 future (ES) and SPDR S&P 500 ETF (SPY)?
A: Trick question. Figure 1. Perfectly at daily and hourly intervals, a bit at minute intervals, uncorrelated at milliseconds.
2. p.4. Do "snipers" add or subtract liquidity?
A: The "snipers" pick off stale limit orders after a public news event, subtracting the liquidity that these "market makers" had provided.

3. p.16. Has the pattern of correlation dropoff at high frequency changed over time, or has it remained constant?

A: Changed, markets got faster. See Figure 4.2

4. To make money, we can't trade at the midpoints of Figure 1.1; we need a price spread that exceeds the bid-ask spread. Around p.20, Budish et al look at such arbitrage opportunities. The opportunity also has to last long enough that a signal can reach from New York to Chicago. What minimum time are they using here?

A: 4 ms. This is the theoretical maximum profit if you can communicate at the speed of light.

5. p. 22. Does New York seem to lag Chicago or vice versa?

A: 88.5% of changes start in Chicago, so Chicago is where "price discovery" seems to happen.

6. p. 25. Has greater competition led to arbitrage opportunities that last for shorter time periods, or has it made arbitrage opportunities smaller, or both?

A: Shorter time, but the size and frequency of price discrepancies is about the same

7. P. 26. Notice that the bid ask spread is smaller in NY. This answers the question, why would anyone trade in NY! It also suggests that "noise traders" may want to specialize in a market where there is little "price discovery," and thus less asymmetric information and smaller bid ask spread.