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BUSINESS

Everything You Need to Know About High-Frequency Trading

Why the algobots that rule Wall Street are good—and why they're evil, too.

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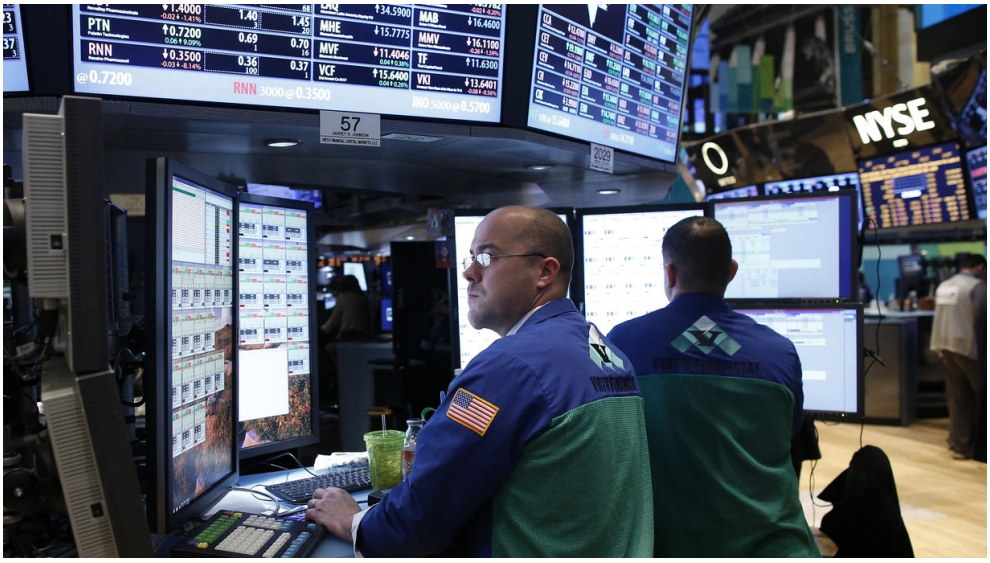
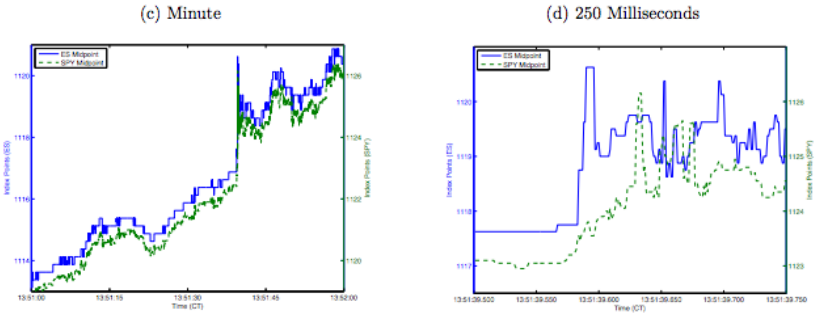


REUTERS

The stock market isn't rigged, but it is taxed.

It always has been. As Justin Fox points out, for as long as people have been trading stocks, there have been middlemen taking a cut of the action. Now, that cut has gotten smaller as markets have gotten bigger and more technologically-advanced, but it's still there. It's the implicit fee that intermediaries charge for making sure there's a buyer for every seller, and a seller for every buyer—for "making markets."

But there's a new kind of middleman today. They don't work at stock exchanges or banks. They work at hedge funds, and trade at whiz-bang speeds. These "high-frequency traders" (HFT) use computer algorithms—a.k.a., algobots—to arbitrage away the most infinitesimal price discrepancies that only exist over the most infinitesimal time horizons. You can see just how small and how fast we're talking about in the chart below from a new paper by Eric Budish and John Shim of the University of Chicago and Peter Cramton of the University of Maryland. It uses 2011 data to show the price difference between futures (blue) and exchange-traded funds (green) that both track the S&P 500. These *should* be perfectly correlated, and they are—at minute intervals. But this correlation disappears at 250 millisecond intervals, a little more than half the time it takes to blink your eyes. This is the "inefficiency" that HFT makes less so.



This rise of the robots certainly seems to have helped ordinary investors. Bid-ask spreads—the difference between what buyers want to pay and sellers want to be paid—have fallen dramatically the past 20 years. Part of this is because, since 2001, stock prices have gone from trading in fractions to pennies—which has allowed them to be increasingly precise. Another part is that electronic trading, though not super-fast, has made markets more liquid. And the last part is that HFT has added even more liquidity, eliminating bid-ask spreads that would have been too small to do so before. Indeed, researchers found that Canadian bid-ask spreads increased by 9 percent in 2012 after the government introduced fees that effectively limited HFT.

That doesn't mean, though, that HFT is unambiguously good. It's not. In fact, it might not even be *ambiguously* good. As Noah Smith points out, we just don't know enough to do any kind of cost-benefit analysis. Now, we do know that smaller bid-ask spreads, which cut the cost of trading, are one benefit. But how much of one is it? Bid-ask spreads are down to around 3 basis points today—from 90 basis points 20 years ago—so even if curbing HFT increases them, say, 9 percent like it did in Canada, we're not talking about a big effect. There might be diminishing returns to liquidity that we've already hit, and then some.

Then there are the costs. Michael Lewis' new book, *Flash Boys*, describes some of them. In it, there's Lewis' requisite group of plucky outsiders—is there another kind?—taking on a rotten status quo. Except this time, they're not really outsiders;

But it's a little bit more complicated than that. Here are the three biggest, though hard to quantify, costs of HFT.

1. Market-taking, not market-making. Lewis' protagonist, a trader named Brad Katsuyama, had a problem. Every time he tried to buy stock for a client, he could only get a little bit of what was supposed to be there at the price he saw. Now, oddly enough, he could get all the stock he saw at one particular exchange, but he had to pay more at all the others. What was going on?

Well, he was being front-run. HFT firms pay public and private exchanges to see their incoming orders. That's why Katsuyama was getting all of his order filled at the exchange closest to him—that is, as the fiber optic cable lies—but nowhere else. The HFTers were seeing his order at the first exchange and then racing to buy all the rest of the stock he wanted everywhere else, so they could sell it to him for more. This happens all the time: Nicholas Hirschey of the London Business School found that HFT funds only tend to buy aggressively right before everybody else does.

It's not too different from what HFTers do when they buy early access to public data. Again, they're paying for a trading advantage that isn't really adding liquidity. It's what Barnard professor Rajiv Sethi calls "superfluous financial intermediation." HFT firms aren't connecting buyers and sellers who might not find each other. They're jumping in between buyers and sellers who would have found each other anyways in a few milliseconds. It's not making markets more efficient. It's cheating.

2. Nobody wants to lose to a robot. "When the market as displayed on his screens became illusory," Lewis writes, "[Katsuyama] became less willing to take risk in that market—to provide liquidity." It's what economists call "adverse selection," and it's a simple idea: HFTers crowd out other traders, because nobody wants to play against someone they know they'll lose to.

That includes HFT funds themselves. As Felix Salmon points out, HFT's share of *all* trading has fallen from 61 percent in 2009 to 51 percent in 2012. Why? Well, the algobots are fighting against each other now, and those fights don't end in trades. They end in fakes quotes—or "spoofing"—that the algobots send to try to draw each other out. Indeed, Johannes Breckenfelder of the Institute for Financial Research found that HFTs change their strategies when they're competing against each other like this. They don't make markets as much, and make directional bets on stocks instead—because those are the kind of things they can actually beat each other on. The result is actually *less* liquidity and more volatility, at least within each trading day. (HFTs don't hold stock overnight, so *inter*day volatility isn't affected).

3. A waste of money and talent. Lots of HFT is personally profitable, but socially pointless—and that pointlessness adds up. Take Spread Networks. Lewis describes in colorful detail how it laid fiber optic cable in as straight a line as possible between Chicago and New York all to shave *three milliseconds* off the time it took to trade between the two. That meant spending $300 million to drill through the Alleghenies, and try to avoid laying fiber on both sides of the road, because each time they did, their CEO explained, it "cost them one hundred nanoseconds."

returns. Is it really worth spending so much money on what, to anyone other than HFT, are unnoticeable improvements—especially compared to what it could have been spent on? Probably not.

The problem, though, is that HFT *has* to spend this money. It's an arms race, and there's no silver medal for finishing second. That's because every HFT strategy depends on not only being faster than ordinary investors, *but being faster than each other too*. Anytime somebody comes up with a new way to cut a few microseconds—that is, a millionth of a second—off of trading time, they have to spend whatever it takes to do it. Otherwise, they'll lose out to their competitors who do.

But it's an intellectual arms race, too. HFT isn't just about the time it takes to send trades through tubes (or between microwaves). It's also about how much time it takes your algorithms to crunch data. And coming up with the best algorithms means you need real math geniuses. Is it really worth diverting so much talent into what, to anyone other than HFT, are mostly unnoticeable market improvements? Probably not. Budish, Cramton, and Shim point out that even though HFT has reduced the duration of arbitrage opportunities from 97 milliseconds in 2005 to 7 milliseconds in 2011, the profitability of them hasn't changed. HFT isn't eliminating these inefficiencies. It's just making them disappear in slightly less of a fraction of a blink of an eye.

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HFT has real costs, but it's hard to add them up. Maybe narrower bid-ask spreads make up for them. But maybe not. It's not as if bid-ask spreads would go back to where they were in, say, 1999 if we restricted HFT.

Though even that's the wrong way of framing things. We don't have to restrict HFT to make markets "fairer." We just have to create market structures that make HFT irrelevant. Those might be exchanges, like Katsuyama's IEX, that protect order information long enough to keep HFTs from front-running them. Or it might be setting up markets that aren't continuous, like Budish, Cramton, and Shim want, but use "batch-auctions" every second instead. Basically, have investors submit bids every second, rather than leaving bids out there that can be filled at any millisecond. These could give us most of the benefits of HFT without the costs. At the very least, they're worth trying.

The market has bigger problems than robots, but that doesn't mean we shouldn't care about making it a little less taxed. If only because we don't want people to be so scared that it is rigged that they stay away.