

JEFFERIES EQUITIES WHITE PAPER | 2019

# **Jefferies**

What's that crashing sound follows us around? That's the sound of all things good breaking Everything is Awful. The Decemberists

#### When the *Market* Moves the Market

In 2018, it was particularly fitting that the song *Everything is Awful* was written by The Decemberists.

After the worst December since 1931, and in the absence of a single clear catalyst, we are taking a step back to reflect on what went wrong (most things), what went right (not much) – and what may have contributed to this.<sup>1</sup> To better understand the landscape, we are looking at how much has changed in recent years.

Let's start with a comparison. For decades, football players have played their game on a 100-yard gridiron. The rules are clear - if complex - and more or less endure over time.

But what would happen if these football players showed up and realized their field had turned into a baseball diamond? Not overnight, but over time and bit by bit – the parameters, size and shape of the turf morphed into something else entirely? They would still know how to dominate a football field, but other changes would mean the game, the rules and the very ground they played on had changed considerably.

What if that is what's happened to trading and execution over the last decade?

Since the global financial crisis, the terrain of investing, trading and execution has changed so considerably that it's possible participants are playing a much different game than when they logged onto their Bloomberg terminals in the mid 2000s.

When the Market Moves the Market will explore a number of these shifts including:

- Who is trading. Non-rules based actors now likely account for less than 30% of daily volume.<sup>2</sup>
- What they're trading. Growth of products and decline in trading costs have seen ETFs and other indexed products soar from less than \$700 billion pre-crisis to more than \$5 trillion in 2018 - while the number of publicly traded U.S. companies waned.<sup>3</sup>
- When they're trading. The open and end of day have long been critical trading junctures. But a number of factors has concentrated even more trading in the last 10 minutes of the day and closing auction – NYSE closing auction share of NYSE-listed trading (the world's most liquid equity market) now tops 8%.<sup>4</sup>
- How they're trading. High frequency volumes have receded from their immediate precrisis highs, but still comprise about 50% of daily volume,<sup>5</sup>
- Where they're trading. Regulation, fragmentation and expansion of markets means that traders can execute on one of over 200 venues globally,<sup>6</sup> and

How these factors may combine.

When the Market Moves the Market examines these changes - some obvious, others more subtle. It explores how much has changed – and what some of the implications of these shifts have been. Much of this piece focuses on the global equity markets, but the changes in the currency, commodity, fixed income or derivative markets have been no less severe. We do not take a stand on whether these changes have been positive or negative; rather, that in aggregate they result in a considerable shift in investing over the last decade.

Alternative titles for this piece included: Who Moved My Market, Everything I Need to Know About Trading I Learned at 3:59 PM, The Final Countdown and Liquidity: Endgame.

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#### THE ROAD TO NOW: MARKET STRUCTURE VITAL SIGNS

	ΤΗΕΝ			NOW		
<b>К</b>	• •	2007 <sup>7</sup> HFT: 35% Active managers: 53% Passive managers: 12%	• •	<b>2018</b> <sup>8</sup> HFT: 50% Active management:30% Passive management: 20%		
WHAT	•	<b>2007</b> <sup>9</sup> Active funds: \$2.5 trillion Passive funds: \$700 billion	•	<b>2018</b> <sup>10</sup> Active funds: \$4.5 trillion Passive funds: \$3.9 trillion		
WHEN WHEN	•	2007 <sup>11</sup> First 30 mins.: 11.75% ADV Last 30 mins. (ex-closing auction): 16% ADV Closing Auction: 3% ADV	• •	2018 <sup>12</sup> First 30 mins.: 5.5% ADV Last 30 mins. (ex-closing auction): 25% ADV Closing Auction: 8.2% ADV		
CONCENTRATION Top holder ownership		<b>1930</b> <sup>13</sup> 10.55%		<b>2018</b> <sup>14</sup> 33.4%		
CAPITAL FLOWS	<ul> <li>2007 – 2017<sup>15</sup></li> <li>\$1.9 trillion of inflows to active products</li> <li>\$3 trillion inflows to passive products</li> <li>\$1.3 trillion of inflows to hedge funds</li> </ul>					
S MARKET CAP	World	<b>2007</b> <sup>16</sup> \$60.305 trillion 43,984 companies		<b>2018</b> <sup>17</sup> \$68.65 trillion 43,342 companies		
	U.S.	\$19.992 trillion 5,109 companies		\$30.436 trillion 4,336 companies		
VOLUMES (U.S.)		2009 <sup>18</sup> \$220 billion 9.8 billion shares		<b>2018</b> <sup>19</sup> \$357 billion 7.3 billion shares		

#### Who Is Trading Has Changed

One of the biggest shifts in market structure has been the move from "who" is trading...to *what* is trading – meaning who (or what) is most active in the market. And there are a few dimensions to this change.

This is as much related to as execution *er* as their *style* of execution. A human discretionary trader is probably best defined by what she *isn't*. Discretionary traders are *not* bound by preset or fixed rules, as quant or algorithmic traders are. Sometimes she executes on gut instinct, market feel, information from brokers or other sources, or other drivers of decision making that aren't required to abide by other pre-established rules.

A critical shift has been in individuals using their own decision making to execute trades with other humans, to some individuals using their own decision making to execute trades *via algorithms* (meaning the human decides when to initiate a buy or sell, but the algorithm decides where and sometimes precisely when and how) versus the algorithm, which was written by a human, deciding to execute against another algorithm.

Traders logging onto Bloomberg terminals more than a decade ago would likely be preparing to do battle with other human traders – very typically, other discretionary ones. In 2003, more than 80% of the average daily traded volume of equity markets was non-algorithmic – that is to say, non-rules-based.<sup>20</sup> Discretionary investors would decide to buy or sell a security, call their broker (also a human), and in the 1990s and early 2000s, mostly find their trade executed in a human – human interaction. Over the next decade, that tradition withered.

When	Long Ago (The 1990s and early 2000s)	A While Ago (Early 2000s – late 2000s)	Now	
Who determined buy/sell	Human	Human	Algorithm	
How they executed	Human	Human or Algorithm	Algorithm	

Note: Algorithmic or rules-based trading has existed for decades buts did not reach broader audiences until the mid-2000s. Even now, there is still human execution, but it has decreased substantially.

The rise of algorithmic trading – or trading executed under a regime of various sets of rules and signals – skyrocketed in the immediate pre-crisis era. Between 2006 and 2008, rules based or algorithmic trading doubled, from 30% to more than 60%, before topping out in the early 2010s at more than 80% of ADTV.<sup>21</sup> Discretionary traders may still call a broker to execute a trade, but they were also increasingly given the tools on their own workstations to execute their trades using a variety of algorithmic and rules based strategies.

Another wrinkle in this? In the last decade, the proportion of equity trading conducted by different types of market participants has changed considerably. Bank prop trading (in which a bank acts on its own account, taking risk), has cratered by 80% - from more than 12% of trading to about 2.5%.<sup>22</sup> Different hedge fund strategies have traded places, with quant activity rising materially – in fact, nearly doubling to more than 25% of activity. Other non-quant hedge fund activity has declined from 25%, peaking close to a third, before declining to just over 22.5%.<sup>23</sup> Traditional asset managers have also witnessed activity decline.



Source: Tabb Group

As recently as 2003, if you showed up to trade equities, it was unlikely you were anything except an active money manager. By 2007, that had changed somewhat with the ascent of high frequency (HFT) and measured growth of passive management, as active managers accounted for a material – but shrinking – percentage of ADV of shares (in 2007, still more than half). As HFT and other forms of liquidity provision increasingly replaced human pit traders, there was also a decline in counterparties *needing to show up in periods of acute stress*.

THE "**WHO**" OF TRADING HAS BECOME INEXTRICABLY LINKED WITH THE "**HOW**" OF TRADING, AS EXECUTION TRANSITIONED FROM HUMAN DRIVEN TO ELECTRONICALLY-LED, *AND* THE PROPORTION OF WHAT *TYPES* OF HUMANS ARE TRADING CHANGED.

Viewed through another lens, by 2018, active managers only accounted for just over a third of ADV, high frequency trading accounting for around 50% (up from 30% a decade ago, but down from it's precisis peak) and the balance by passive funds – those who had been a de minimus amount of the market as recently as the 1990s (see definitions in Box 1). <sup>24</sup> Notionally, this amount hovers near its 2003 level. As a percentage – active management has transitioned from *being* the market to being just *one-third* of the market. Passive funds again, are both a type of product *and* a type of trader, and in many instances, these questions around participation need to be viewed through multiple lenses.

Even more striking: some estimate that only 10% of daily trading is initiated by fundamental discretionary investors – those who ground buys or sells on fundamental analysis, and are sometimes what come to mind when we say "active management." Buyers and sellers on either side of a trade used to share mirror image motivations for entering the trade. The buyer anticipated the value/price would increase and had capital to express that view. The seller either *needed* the capital underpinning that trade or felt the value/price of the asset would decline. Or both.

Not anymore. The motivations driving market participants to trade are endless – HFT firms, for example, don't have a directional view on the market. They are liquidity providers. And this has additional ramifications in terms of where they execute, and how long they

#### Definitions

Active management – discretionary (nonrules based) investing. Includes all hedge funds, including quantitative and other rules-based managers, fundamental hedge funds, actively managed mutual funds.

**Passive funds** – ETFs, indices or other strategies where the underlying product tracks an index or theme.

**High frequency trading (HFT)** – automated trading strategies grounded in algorithmic patterns to provide liquidity.

hold positions, among other factors. It also has strong implications (as others have explored elsewhere) – as to what happens to liquidity in periods of acute stress when the "new liquidity providers" *don't necessarily have to continue to show up*. The profile of market participants trading on any given day, and potentially in periods of acute stress, (and their motivations) has shifted considerably.

MULTI-DIMENSIONALITY. ONE OF THE MOST INTERESTING TAKE AWAYS OF THIS RESEARCH HAS BEEN THE EVOLUTION OF HOW MULTI-DIMENSIONAL QUESTIONS ABOUT TRADING AND THE MARKET HAVE BECOME. WHETHER **GROWING TYPES OF ACTORS** (ACTIVE, PASSIVE, HFT, BANK PROP, QUANT, ASSET MANAGER), TRADING A **GROWING NUMBER OF PRODUCTS** (SINGLE STOCKS, INDICES, PASSIVE FUNDS) IN AN **INCREASING NUMBER OF WAYS** TO EXECUTE.

- IS IT MORE IMPORTANT THAT HFT IS A MODE OF EXECUTION OR A TYPE OF COUNTERPARTY?
- ARE PASSIVE FUNDS PRODUCTS TRADING STRATEGIES OR ACTORS IN THE MARKET? OR ALL THREE?
- WHERE DO THE LINES BETWEEN QUANTITATIVE, ALGO AND HFT STRATEGIES BEGIN AND END? DOES IT MATTER?

AS IN OUR FOOTBALL METAPHOR, TO UNDERSTAND HOW THE TERRAIN AND RULES HAVE CHANGED, EACH DIMENSION OF THE TRADING LANDSCAPE – FROM THE PLAYERS TO THE RULES TO THE SHAPE OF THE FIELD – NEED TO BE EXAMINED FROM MULTIPLE PERSPECTIVES

#### What They're Trading Has Changed...(Hasn't It?)

So we've moved from human investors executing with human traders to (for the most part) rules based algorithms executing via...rules based algorithms. At the same time, the scope of *what exactly* they are trading has changed – with the number of single stock securities declining (but on average being worth more), as the number of indexed or bucketized securities has grown. Over the last decade, as the number of publicly traded companies has declined, and their average market cap has grown, the total number of shares outstanding has grown, but has also remained largely range bound. This creates a smaller universe of single names for fundamental investors to buy or...short.

In 2007, the U.S. domestic equity market cap topped out around \$11.6 trillion. In the 12 years since, it's grown to more than \$32 trillion, *but across a shrinking number of listed companies.* Today, traders and investors survey 4,397 firms, down from over 5,000 in 2007 – and half the 1996 peak of more than 8,000.<sup>25</sup> Around this 1996 peak - the U.S. domestic equity market cap in 1996 - \$12 trillion.<sup>26</sup> More broadly – total global market cap tops \$80 trillion across 42,099 companies, up from \$2.5 trillion across 42,520 firms in 2009.

	U	l.S.	WORLD		
	Then	Now	Then	Now	
Market Cap	\$11 trillion in 2008 <sup>27</sup>	\$30.4 trillion <sup>28</sup>	\$32.2 trillion in 2008 <sup>29</sup>	\$68 trillion in 2017 <sup>30</sup>	
# Listed Companies	4,666 in 2008 <sup>31</sup>	4,336 <sup>32</sup>	44,040 in 2008 <sup>33</sup>	42,099 <sup>34</sup>	
Market Cap of 100 Largest Companies	\$3.805 in 2009 <sup>35</sup>	\$18 trillion	\$8.402 in 2009 <sup>36</sup>	\$21.7 trillion <sup>37</sup>	
Average company market cap size	\$2.3 billion	\$6.9 billion	\$731 mm	\$1.6 billion	

Interestingly – there are twice as many hedge funds than publicly traded U.S. companies (~10,000 hedge funds vs. fewer than 4,500 publicly traded U.S. companies).<sup>38</sup> And by some accounts, there are as many – if not more - *broker dealers* in the U.S. than publicly traded companies.

So a growing number of investors are surveying a shrinking universe of single names to investigate for their portfolios, changing the very nature of how people think about asset allocation. While there has been growth in index securities, which we address later, liquidity of these is unevenly dispersed, and most – by definition – are thematic rather than precisely focused on a single firm, limiting their use in certain alpha seeking portfolios.

Also worth noting: other major public capital markets in the United States include the ~\$16 trillion (publicly held) U.S. Treasury market, the \$8.5 trillion corporate bond market, and the \$500 trillion+ (notional amount) global derivatives markets.<sup>39</sup> Participants in these markets include approximately 4,500 domestic public companies, nearly 4,000 broker-dealers, and millions of global investors.<sup>40</sup>

Over the last 20 years, the number of public companies in the United States has dropped by nearly 50%.<sup>41</sup>

But this has happened at exactly the same time as a new form of equity linked security has exploded: the ETF or indexed product. So while single *name* stocks have cratered, the number of ways to express broader investment views or longer term themes has increased.





Source: The World Bank

A GROWING NUMBER OF INVESTORS ARE SURVEYING A SHRINKING UNIVERSE OF SINGLE NAMES TO INVESTIGATE FOR THEIR PORTFOLIOS, CHANGING THE VERY NATURE OF HOW PEOPLE THINK ABOUT ASSET ALLOCATION.

WHILE THERE HAS BEEN GROWTH IN INDEX SECURITIES, WHICH WE ADDRESS LATER, LIQUIDITY OF THESE IS UNEVENLY DISPERSED, AND MOST – BY DEFINITION – ARE THEMATIC RATHER THAN PRECISELY FOCUSED ON A SINGLE FIRM, LIMITING THEIR USE IN CERTAIN ALPHA SEEKING PORTFOLIOS.

New Securities Rising: Explosion of "Passive" Products

#### Is "Passive" A Misnomer?

Decisions to participate in global markets are active ones. By entering the market at all – your long bets wager they will increase in value, your short bets wager they will *decrease* in value. But they aren't passive – owning or shorting an ETF and calling it a passive investment is somewhat like betting an American League team will win the World Series, rather than, say, the Yankees. Both are active bets – but one is more specific than the other.

The definition of passive, again, means more of what it isn't than what it IS. Passive means to lack action, or to accept or permit what happens or what others do - without active response or resistance.

But so called "passive" investing, can be anything but. Leveraging a broadly indexed product or basket of securities brought together under one (tradeable) umbrella, still requires the investor to make a directional bet that that basket or group of securities will increase or decrease in value. They just do it at a thematic rather than single security level. ETFs (Exchange Traded Products) have existed since 1990. But they only rose in prominence and popularity over the last 15 years. ETFs now account for more than \$4 trillion in global assets across more than 5,000 products.<sup>42</sup> A smaller number of ETFs account for an outsize percentage of assets – for example, just 20 ETFs welcomed more than 50% of the massive net inflows in 2017. BlackRock estimates ETFs could grow to over \$12 trillion by 2023, and Fidelity notes that ETFs now account for more than 18% of US equity trading volume. <sup>43</sup> ETF trading can exceed 2 billion shares per day.<sup>44</sup>

So the U.S. has witnessed a decline in the number of individual publicly traded companies (i.e. – single name stocks to invest in or short), while simultaneously witnessing explosive growth and use of passive products ("buckets" of single name stocks classified by market cap, weighting, theme, or other classification).

This has resulted in investors' ability to make broader, cheaper, more thematic bets, but has decreased the potential universe of single name longs and shorts in their portfolios. With nearly 400 sector and other narrowly based ETFs, active managers have more tools at their disposal for expressing their views, and for expressing them more cheaply than ever before. <sup>45</sup>

ETFS

5

Number

otal





**Of note:** Between 1930 and 1975, the S&P 500 lost more than 20% in a year **four times:** 

- 1930 - 1931 - 1937, and - 1974.

From 1975 – 2018, there have only been two such moves: 2002 and 2008.<sup>51a</sup>

#### How Much They're Trading Has Changed

U.S. volumes peaked in 2008 at \$47.245 trillion, beating a strong 2007, which witnessed \$42.853 trillion in value traded. It has since declined by nearly a third, with 2018 volumes hitting just \$33.027 trillion.<sup>46</sup> Daily volume on U.S. equity exchanges averaged 7.5 billion shares in the first two months of 2019 – an increase over the 6.8 billion in the same period in 2017, and 7.6 billion in 2018.<sup>47</sup> Of this – ETF volume as a percentage of U.S. total ranges between ~15 – 20% of daily volume (hovering around 18% on average), and reached a peak in December 2018 of nearly 25% of total.<sup>48</sup>

So a smaller number of individual companies – but with higher market caps, on average – along with a growing number of indexed products, we are *still* witnessing declines in notional volume traded. We're trading (as you'll hear in a subsequent section) more frequently – that is, we're holding securities for smaller amounts of time – but across lower notional volumes.



Source: SIFMA, Jefferies

For certain exchanges, shifts in volume have been more acute



Source: NYSE, NASDAQ, Jefferies

What we're seeing is a market that is streamlining, strengthening, and centering around a steadying number of companies. This phenomenon—which sees the list of tickers that make up the market simplifying or shortening—is occurring at the very same moment that market structure is becoming more dimensional, complex, and multi-faceted.

This inverse relationship matters.

Perhaps, it marks a shift in focus on the part of investors, whose success used to rely on their ability to trade large volumes for large returns. Increasingly, investing well has come to mean executing a highly nuanced strategy, in more precise lots, across fewer names. No doubt, this is a result of an exploding data landscape and our growing ability to analyze that data in sophisticated ways.

#### Shift in Traded Products and Volumes

			of Indexed lucts	Daily Volumes   Shares (2008 – 2018)		Daily Volume in USD (2009 – 2018)	
		1			7		
2008	4,666	2008	1,622	2008	8.8 billion	2009	\$220 bn
2018	4,336	2018	6,478	2018	7.3 billion	2018	\$358 bn

Source: SIFMA, The World Bank, Jefferies

MAYBE IT'S INTUITIVE: FEWER SINGLE NAMES TO TRADE, VOLUMES WOULD DECREASE. BUT GIVEN THE RISE IN HIGH FREQUENCY AND SHORTER DURATION ALGORITHMIC TRADING, THE DECLINE IN TRADING VOLUMES IS NOTABLE – ESPECIALLY WHEN ETF VOLUMES ARE FACTORED IN.

#### Where They're Trading Has Changed

Many think of equity exchanges as a venue through which trade is facilitated – a somewhat neutral landscape created and maintained for those looking to buy or sell securities to match with those looking to sell or buy them. But as Maureen O'Hara astutely noted in the *Journal of Financial Economics*, they are not neutral facilitators: **Exchanges themselves**, through a combination of policy, rules or incentives, can actively shape market activity.

"Exchanges act strategically as well, opting for new pricing models and market designs to attract (and, in some cases, deter) particular volume to their trading venues. As a result, trading has changed, and the data that emerge from the trading process are consequently altered."<sup>49</sup> To keep returning to our athletic field metaphor – it's giving the groundskeepers and owners a say in the terrain the game is played on.

The landscape of exchanges has changed over the last decade, with both consolidation and fragmentation, and a new era of "systematic internalizers" arising on the back of MIFID II legislation in Europe. There are an increasing number of venues on which traders can seek or offer liquidity – resulting in potential ongoing silo'ing of where transactions can occur, as well as potential division of liquidity in periods of acute stress. While the vast majority of transactions still happen on the largest and most liquid exchanges, patterns of use vary across stressed or other acute periods.



#### When They're Trading Has Changed<sup>51</sup>

With the rise of indexing, some funds increasingly have a mandate to track a benchmark calculated daily using closing prices. This is contributing to increased participation in markets' daily closing auctions, where liquidity is concentrated. The rise of passive trading has also affected equity markets' microstructure, most notably in the shift of daily volume trading curves.

Since 2005, the end of the trading day has taken on increasing importance in the U.S. as 16% percent of the daily trading volume occurs in the last half hour; an additional 8 percent happens in the market-on-close (MOC) auctions.<sup>52</sup> Over time, material trading volumes have largely shifted to concentrate around the open and the close of market hours, with particular focus on the close of the trading day. The 4:00 pm time stamp can represent 10-12% of the total trading volume on any given day, in addition to those MOC orders that have been input in advance of a stock's end-of-day moves.

This extreme concentration in trading traffic coupled with the ability to trade at increasingly quick speeds have resulted in an environment where traders not only can wait until the last minute, second, or millisecond of the trading day to complete their order, but that doing so may, in fact, actually benefit them from a liquidity and price capture standpoint.

Brokers and broker/dealers have focused on leveraging their data on the trading patterns throughout the day - and in many cases have focused their efforts on using this data to write algorithms that their clients can use to garner as much liquidity into the close without impacting price.

As time marches on, the potential (and, in some cases, necessity) to gather data on the last minutes of the day increases. The intel this analysis provides will only become increasingly rich, particularly as the percent of US trading volumes throughout the day continue to coalesce around the open and the close. To get even more granular still: while the chart of trading volume over the day used to resemble a symmetrical smile—with the highest volumes of trading occurring in relatively equal measure at both the open and the close—this graph now looks like a smirk. Out of the gate at 9:30, a significant volume of trading occurs, but it is really at the end of the day—via market-on-close orders and live trading in the last ten minutes of the day—that the highest volume of activity occurs.<sup>53</sup>

**US Stock Trading Volumes** 



#### Speed of trading - From High Frequency Trading to AI Frequency Trading

Innovations in technology and engineering have increasingly enabled trading speeds to creep ever closer to instantaneous. The technologies that need to be updated to increase trading speeds run the gamut from hardware and infrastructure—think computers, servers, and the fiber optic cables that facilitate communication between these—as well as the software and programs that run on these computers to execute trades.

The most recent innovation has been to increase trading speeds from seconds to milliseconds or even microseconds or nanoseconds. The traders making use of these technological capabilities—running High (and ever higher) Frequency Trading (HFT) strategies – often holding a stock for less than a second, and providing much of intraday liquidity.<sup>54</sup> And investors' need for speed has still not been satisfied. Certain alternatives funds have been reportedly developing an ultrafast trading system based on atomic clocks.<sup>55</sup>

This has materially impacted the overall average holding period of stocks in the modern era. In 2016, HFT or highspeed trading strategies accounted for a little less than 50% of all equity trading.<sup>56</sup> In the same year, NYSE reported that the average holding period for a single name stock was 8.3 months, as compared to roughly 8 years in the mid 1950s.

There is one caveat to all this innovation: now that investors can enter and exit positions in a matter of moments, it is harder to make money simply by "buying cheap and selling dear." Though it is an oversimplification, high-speed trading strategies make money by selling at a penny-wide profit in large volumes. Many have argued that lower trading latency leads to more efficient markets, tighter bid-ask spreads, and ultimately a much more competitive playing field.

#### How Jefferies Can Help

That things have changed in the investing, trading and execution landscape is news to no one. But the magnitude of multiple changes has been appreciated by a smaller group of investors – and an even smaller group still knows how to effectively navigate these far reaching and ongoing changes.

Jefferies Electronic Trading Solutions (ETS) has conducted considerable research and deep dives on the implications of many of these shifts for a diverse array of portfolios. Not all portfolios are impacted in the same way across the same time horizon, and the motivations for entering and exiting trades vary widely.

They are in ongoing dialogue with clients of all shapes, sizes and strategies to create ways to best navigate various market opportunities, and have created a highly ranked suite of products to address various needs.<sup>57</sup> As the franchise has grown and evolved, what started as tools to make traders more efficient and facilitate VWAP/TWAP trading, the portfolio of offerings has multiplied and become markedly more sophisticated.

The rise of dark pools and ongoing fragmentation created a need for liquidity seeking algorithms. The newest innovation in the space is more promptly and effectively seeking liquidity traders know is available, but that they have trouble accessing. There are a number of algos that now help traders access the close for a variety of different objectives.

As broker bias grew as a concern for buy side traders, the growth of algo "wheels" is facilitating achieving many different trading objectives. These wheels also enable better measurement of algo performance – in growing demand in an era where every basis point counts and trade efficiency is paramount.

As trading has become faster, more complex, and multidimensional, the Jefferies ETS and Equities teams are dedicating ever more focus and resources to helping clients successfully navigate these changes. Please contact us with any questions.

#### **ENDNOTES**

- <sup>1</sup> Dow Jones Market Data Group
- <sup>2</sup> Tabb Group
- <sup>3</sup> iShares, Bloomberg
- <sup>4</sup> New York Stock Exchange (NYSE)
- <sup>5</sup> Tabb Group
- <sup>6</sup> World Federation of Exchanges, SEC
- <sup>7</sup> The Financial Times, Tabb Group
- <sup>8</sup> The Financial Times, Tabb Group
- <sup>9</sup> EPFR, Jefferies
- <sup>10</sup> EPFR, Jefferies
- <sup>11</sup> The Financial Times
- <sup>12</sup> The Financial Times

<sup>13</sup> "Berle and Means show that, of the largest 200 corporations in 1930 that they listed as being controlled by hired managers (rather than run directly by owners), the aggregate percentage of the corporations equity owned by the corporation's largest 20 shareholders had a mean of 10.55%." In 2016, top 20 holders of the 20 largest U.S. companies held a mean of 33.4% of the company. Bebchuk, Lucian A., Alma Cohen and Scott Hirst. "The Agency Problems of Institutional Investors," *Journal of Economic Perspectives*. Volume 31, 2017, pp. 89-102.
 <sup>14</sup> Bebchuk, Lucian A., Alma Cohen and Scott Hirst. "The Agency Problems of Institutional Investors," *Journal of Economic Perspectives*. Volume 31, 2017, pp. 89-102.

- <sup>15</sup> EPFR, Jefferies, HFR
- $^{\rm 16}$  The World Bank
- <sup>17</sup> The World Bank
- 18 SIFMA
- 19 SIFMA

<sup>20</sup> "The Future of Algorithmic Trading," Experfy, https://www.experfy.com/blog/the-future-of-algorithmic-trading

<sup>21</sup> "The Future of Algorithmic Trading," Experfy, https://www.experfy.com/blog/the-future-of-algorithmic-trading

<sup>22</sup> Tabb Group, and publicly available at: "The Quants Run Wall Street Now," The Wall Street Journal, May 21, 2017

<sup>23</sup> Tabb Group

- <sup>24</sup> "Not your Father's Market: Tech tantrum shows how U.S. equities trading has changed," The Financial Times, June 14<sup>th</sup>, 2017
- <sup>25</sup> The World Bank
- <sup>26</sup> The World Bank
- <sup>27</sup> The World Bank
- <sup>28</sup> The World Bank
- <sup>29</sup> The World Bank
- <sup>30</sup> The World Bank
- <sup>31</sup> The World Bank
- <sup>32</sup> The World Bank
- <sup>33</sup> The World Bank
- <sup>34</sup> The World Bank
- <sup>35</sup> PWC
- <sup>36</sup> PWC
- <sup>37</sup> https://www.corporateinformation.com/Top-100.aspx?topcase=b
- <sup>38</sup> HFR, The World Bank
- <sup>39</sup> U.S. Treasury please note this number does not reflect intragovernmental holdings
- <sup>40</sup> U.S. Treasury: <u>https://www.treasury.gov/press-center/press-releases/documents/a-financial-system-capital-markets-final-final.pdf</u>
- <sup>41</sup> Ibid.
- <sup>42</sup> The FT and The ETF Directory
- <sup>43</sup> BlackRock
- <sup>44</sup> Fidelity and The World Federation of Exchanges
- <sup>45</sup> ETF Database
- <sup>51a</sup> MacroTrends
- <sup>46</sup> The World Bank
- <sup>47</sup> Jefferies ETS

<sup>48</sup> Jefferies ETS

<sup>49</sup> Maureen O'Hara. "High frequency market microstructure." Journal of Financial Economics. 26 August 2014.

<sup>50</sup> Several research firms provide estimates of market share breakdown by venue, for example, Rosenblatt Securities. Publicly, this information is available in white papers such as "A Financial System that Creates Economic Opportunities: Capital Markets," October 2017, published by the U.S. Department of the Treasury and available on *Treasury.gov*.

<sup>51</sup> Several research firms provide estimates of trading volume and its dispersion throughout the day, for example, Credit Suisse and the Tabb Group. Publicly, this information is available in articles such as "The 30 minutes that have an outsized role in US stock trading," April 24, 2018, *FT* and Trading Strategy: It's Closing Time, September 12, 2017, *Credit Suisse*.

<sup>52</sup> Ibid. <sup>53</sup> Ibid.

<sup>54</sup> "High-frequency trading has reshaped Wall Street in its image," March 17, 2017, Market Watch

<sup>55</sup> "Trading on Speed," July 21, 2017, *Bloomberg* 

<sup>56</sup> "High-frequency trading has reshaped Wall Street in its image," March 17, 2017, *Market Watch* 

<sup>56</sup> Greenwich Associates

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