



## RESEARCH

### Insights

# The ABCs of Equity Market Structure

How US Equity Markets Work and Why

April 2023

### Key Takeaways

Key to delivering efficient, reliable, and low-cost markets is the underlying market structure. Before we can deep dive into the data, we must set the foundation to analyze market structure. This note does just that, explaining terminology, market participants, and the structure of markets:

- **“The” retail investor is not monolithic:** 53% of U.S. households own equities. Individual investors in the \$100K-\$1M tier represent 33M HH & hold \$6.5T in assets; 78% use financial advisors, average relationship size \$135K. Technically there is no definition of retail investor in equity market structure
- **Firm business models are not monolithic:** Different business models serve different customers with different investment objectives/trading requirements. 35K firms (90.3% inv advisors, 8.3% BDs, 1.4% dual), 690K registered reps. Labeling firms can be complicated – firms may hold multiple labels (market maker, broker-dealer, etc.)
- **Equities not equal to listed options:** equities ~8.3K securities, options ~1.5M strikes. 16 exchanges each; differences exist. Equities order driven, options quote driven. Auctions exist in equities but expanding to retail orders brings up questions, such as how to design and what if no take up
- **Cash flows across the trading ecosystem:** Net trading revenue 62.1% of reported revenue for order routing/execution firms. Equities 9.1% of total net revenue for exchanges, transaction revenues 60.0%. Exchanges' cost of revenues 82.1% of total equities revenues, order routing/execution firms' transaction expenses 47.0% of total operating expenses. SIP market data revenue \$414.4M (5Y avg). PFOF/net price improvement = 0.3x – price improvement much greater. Section 31 fees \$376.5M on avg per exchange (FY22), may be passed on to investors

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## Executive Summary

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### Introduction to Equity Market Structure

The U.S. equity market structure ecosystem is complex, with many moving pieces all intertwined to deliver the largest – 41.0% of the \$101.1 trillion global equity market cap, or \$41.5 trillion; 3.6x the next largest market, China<sup>1</sup> – and among the deepest, most liquid and most efficient markets in the world.

Key to delivering efficient, reliable, and low-cost markets is the underlying market structure. Market structure can drive liquidity and trade costs. Therefore, market participants continually strive to create the most efficient markets. This includes adapting new technologies to achieve operational efficiencies, searching for new ways to transact and, generally, sculpting market structure to maximize efficiencies.

Over the last year, much attention was paid by regulators as to whether or not the current equity market structure creates “well-functioning markets that are efficient, competitive, and transparent”. And in December last year, the SEC released its (much anticipated) statement on proposals related to equity market structure. The proposals include: amendments to disclosure of order execution information (Rule 605); changes to tick sizes, access fees, odd lots and round lots; introduction of an order competition rule, aka the auction proposal; and a new SEC version of Regulation Best Execution.<sup>2</sup>

We believe the current ecosystem does serve investors to the fullest. The retail investor has never had it better on trade costs (\$0 commissions) and the ability to execute trades in a quick and cost-effective manner. Institutional investors have many opportunities to access liquidity. That said, we would agree that reviewing regulations and processes in markets over time is a reasonable action. After all, Regulation National Market System (NMS) came into effect in 2005. However, we caution that equity market structure has a lot of tentacles. Opening one aspect could have unintended consequences, such as negatively impacting retail investor participation.

The intent of this report is to break down the complexity of and analyze data for U.S. equity market structure. Before we can deep dive into the data, we must set the foundation to analyze market structure. This note does just that, explaining terminology, market participants, and the structure of markets.

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<sup>1</sup> Source: World Federation of Exchanges as of FY22

<sup>2</sup> Rule 605 requires market centers that trade National Market System stocks to make available standardized, monthly reports containing statistical information about covered order executions. Tick size = smallest price increment in which stock prices are quoted and traded; access fee = paid to exchanges to access protected quotes on its market; odd lots = any number of shares between one and 100; round lots = any lot of shares that can be evenly divided by 100. FINRA Regulation Best Execution = reasonable diligence to assess the best market for the stock, buy or sell in such market so that the resultant price to the customer is as favorable as possible under prevailing market conditions

### “The” Retail Investor is Not Monolithic

We often hear of retail investors being referred to as “the” retail investor. However, the term retail identifies a class of investors, not a single person. This includes a variety of investors with different investment goals, risk tolerance levels, etc. The general classification does not separate out these differences. One thing we do know is that the retail investor is not monolithic.

In this section, we analyze various aspects of retail investing – what both the data and regulators say (or do not say) about defining retail investors – including:

- Equity ownership: 53% of U.S. households own equities; \$32.0T in direct/\$49.2T direct plus indirect equities
- Investable asset tiers: Individual investors in the \$100K-\$1M tier; represent 33M households, hold \$6.5T in assets; 78% use financial advisors, with average relationship size \$135K
- Regulatory definitions: Technically there is no definition of retail investor in equity market structure; do have SEC Rule 605 for execution quality for retail orders and retail order definitions from exchanges

### Firm Business Models are Not Monolithic

The securities industry employs over 1 million individuals, working at over 35 thousand firms. Given the variety of services offered by securities firms, business models are not monolithic. Differences are driven by business objectives – a firm may choose to specialize in a niche area in which it believes it holds a competitive advantage – and cost constraints – it takes money to build out a new business line (not to mention regulatory requirements for ongoing capital commitment for some areas of business). These differences provide investors, both institutional and retail, choice. Investors can choose a full-service firm or may prefer a firm specializing in the business segment which serves their needs.

Different business models exist because firms serve different customers with different investment objectives and trading requirements. As such, not only are business models not monolithic, it would not serve the trading ecosystem or all types of investors to have monolithic business models.

In this section, we breakout the universe of firm types and registered representatives.

- Registered firms: 35,063 firms; +2.2% Y/Y, +1.0% 5-year CAGR. Investment advisor 90.3% of total (31,669 firms, many are very small retail financial advisers); broker-dealer 8.3% (2,914 firms); dual registered 1.4% (480 firms)
- Of which FINRA registered only (dual, broker-dealer) 3,394 firms; -1.2% Y/Y, -1.8% 5-year CAGR. Retail business segment 36.9% of total firms (1,254 firms)
- Despite the decline in firm numbers, total revenues have steadily increased for FINRA registered broker-dealers; \$398.6 billion in 2021, +10.1% Y/Y, 5-Year CAGR 5.4%
- Registered reps: 689,925 RRs; +0.4% Y/Y, +0.1% 5-year CAGR. Dual registered 44.6% (307,590 firms); broker-dealer 44.2% (304,867 firms); investment advisor 11.2% of total (77,468 firms)

- Of which FINRA registered only 612,457 RRs; -0.8% Y/Y, -0.6% 5-year CAGR
- The equity order routing process is complex, and labeling firms can be just as complicated – firms may hold multiple labels: market maker, broker-dealer, retail broker, wholesaler, ATS, etc.

### Equities Not Equal to Listed Options

As 92.5% of the listed options traded today are in equity contracts (versus equity index, as of FY22), it is understandable why many people view the equities and listed options markets as similar if not the same. However, the equities markets operate differently from the listed options markets. In fact, the SEC acknowledged this in their final rule for the 2018 transaction fee pilot, stating “options and equities are materially different types of securities.” In this section, we analyze the some of the key differences:

- # of Securities: equities ~8,300 (includes operating companies, REITs, & ETFs; >11,000 if include mutual funds, closed-end funds, etc.) versus options estimated at ~1,500,000 strikes
- Trading Venues: 16 exchanges each, but no off-exchange trade reporting facility in options
- Market Type: Equities order driven, options quote driven
- Auctions: While auctions do currently exist in equities, the possibility of expanding the role of auctions to certain retail orders brings up questions for market participants. Design? What if no take-up? Roles and responsibilities? Impact on market integrity and ultimately investors?

### Cash Flows across the Trading Ecosystem

In any business, cash flows across participants throughout the supply chain, from production to point of sale. In economics, you can apply several formulas for revenues and costs – price times quantity, summing fixed and variable costs – to analyze cash flows across an industry. In equity markets, the key equation is total trade costs = explicit costs (transaction costs, commissions, taxes, etc.) + implicit costs (bid-ask spreads, price impacts, etc.).

The cash flows making up this equation create revenues and costs for the different market participants. On the institutional side of equity trading, broker-dealers charge clients commissions for performing trading services. Similar payment arrangements are made on the asset management side of the business. The work flow around an investor buying stocks (or ETFs) is no different – payments are made to market participants for their services in the process, representing costs to the payor and revenues to the payee. This ecosystem prior to reaching investors is set up to provide investors with a zero or low commission trading environment.

In this section, we analyze the cash flows across the U.S. equity trading ecosystem.

- Defining cashflows: We explain the cash flows across the equity trading ecosystem, those to order routing/execution firms and exchanges, including access fees, market data, payment for order flow (PFOF); liquidity, routing, clearing, and other fees, plus exchange rebates; and general industry charges.

- Mapping cashflows: We create a generic depiction of the different cashflows across the equity trading ecosystem. The order routing diagram shows directional patterns for monetary payments and order flows.
- Sizing cashflows – financial statement mapping
  - Order routing/execution firms – We then analyze the revenue breakout for order routing/execution firms, indicating net trading revenue is only 62.1% of reported revenue after deducting transaction-based expenses.
  - Exchanges – We show revenue breakouts for exchanges, including what percent of total net revenues U.S. equities represents (9.1% on average, range 5.2%-21.8%) and a look at transaction versus non transaction revenues (transaction 60.0% on average, range 45.6%-65.8%).
- Sizing cashflows – trading ecosystem mapping
  - We analyze cash flows paid by both order routing/execution firms and exchanges, looking at the cost of revenues each group must pay to generate trading revenues. Order routing/execution firms' transaction expenses 47.0% of total operating expenses, 2.2x employee related expenses, typically the largest expense line item for a corporation. Exchanges' cost of revenues 82.1% of total U.S. equities revenues on average.
  - We then look at the SIP market data revenue pool, \$414.4 million per annum on average (+1.9% five-year CAGR).
  - We size out PFOF, which averaged only \$0.00040 per share in equities over the last three years, and PFOF/net price improvement was on average 0.3x – price improvement received by investors was much larger than payments made.
  - Section 31 fees, which averaged \$376.5 million across the top three exchanges in 2022, may be passed along the trading ecosystem and paid by investors, both retail and institutional.

### Additional Equity Market Structure Reports

We invite you to read these additional notes:

- [Why Market Structure and Liquidity Matter](#)
- [Analyzing the Meaning Behind the Level of Off-Exchange Trading](#)
- [Analyzing the Meaning Behind the Level of Off-Exchange Trading, Part II](#)

## **“The” Retail Investor Is Not Monolithic**

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We often hear of retail investors being referred to as “the” retail investor. However, the term retail identifies a class of investor, not a single person. This includes a variety of investors with different investment goals, risk tolerance levels, etc. The general classification of “the” retail investor does not separate out these differences.

That classification also does not differentiate between individuals who are trading versus investing. In general terms, retail investors with a goal of saving for retirement may seek returns over a longer time horizon and may practice a buy and hold strategy. Retail traders may be monitoring markets for economic data and trends, day-to-day chart patterns, etc. and may buy/sell stocks over a shorter time horizon. Retail traders typically take on more risk, and trade more frequently, with the goal of seeking out profitable patterns to capitalize on the price fluctuations in stocks.

From the equity trading lens, these differences will translate to varying judgments of best execution, which is meant to be specific to a client. From the equity market structure lens, we note that, technically, there are not actual definitions of a retail investor or retail trader. One thing that is known is that the retail investor is not monolithic.

In this section, we analyze various aspects of retail investing – what both the data and regulators say (or do not say) about defining retail investors.

What the Data Says

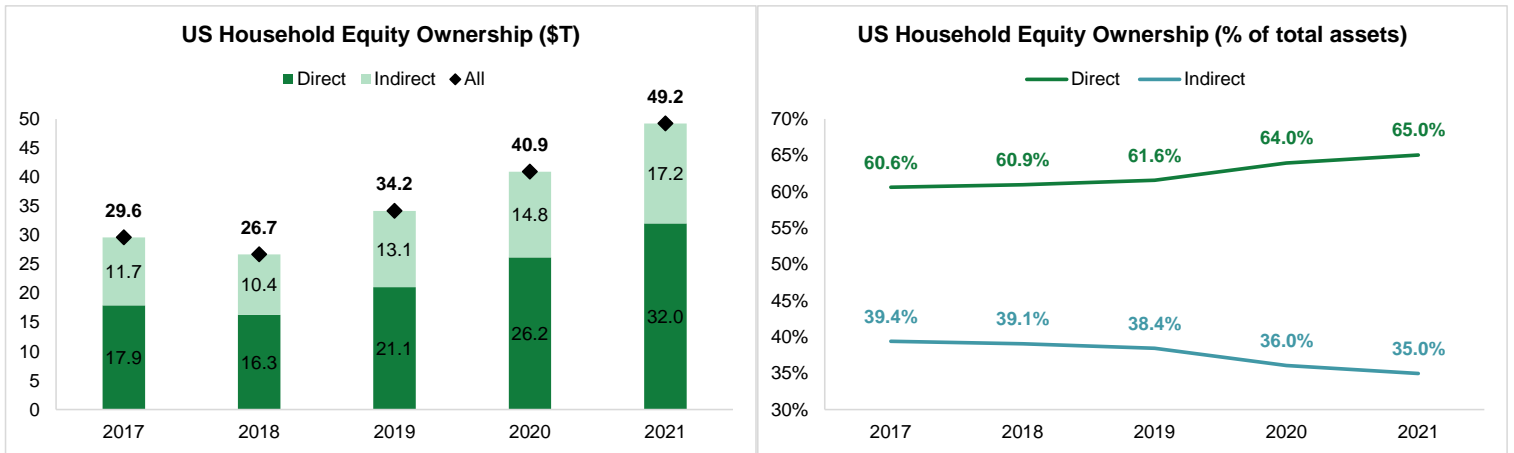
Household Equity Ownership

We begin by sizing out the retail market, in terms of ownership of stocks. The Federal Reserve indicates 53% of U.S. households own equities, either directly or indirectly (which includes mutual and other funds). However, this estimate is outdated – this figure is from a triennial survey which was last published in 2019<sup>3</sup> – and believed to be understated.

To dive deeper, we look at one of the Fed’s more recently updated data sets, Financial Accounts data. As shown below for 2021, U.S. households owned \$49.2 trillion in equities, in terms of market value of assets for both direct and indirect holdings:

- **Total** – \$49.2 trillion; +20.2% Y/Y, +43.9% since 2019
- **Direct** – \$32.0 trillion; +22.3% Y/Y, +52.1% since 2019
- **Indirect** – \$17.2 trillion; +16.6% Y/Y, +30.9% since 2019

While all categories have seen solid growth since 2019, direct equity ownership outpaced growth in indirect, growing 21.2 pps faster. The data shows direct investment has been driving overall growth in U.S. household equity holdings. Looking at this another way, direct ownership of equities as a percent of total has grown from 60.6% in 2017 to 65.0% in 2021. While not perfectly correlated, if you extrapolate the growth in equity trading volumes to equity ownership, the 53% could have grown as well given the increase in direct investment.



Source: The Federal Reserve - Financial Accounts of the United States

Note: Market value as of 2021. Households include nonprofit organizations; all includes both directly and indirectly held equities (ex: mutual funds)

<sup>3</sup> The 2022 Survey of Consumer Finances will be released in the fall of 2023



## Retail Trading Activity

Looking to trading activity in equity markets, it is estimated that historically pre COVID 10% of equity trading volumes were attributed to retail investors. This level began to grow in late 2019 once commissions were reduced to zero. Our annual equity market structure survey<sup>4</sup> at the start of this year showed that respondents estimated the level of retail investor participation is now at 20-30%. Further, Nasdaq Chief Economist Phil Mackintosh used internal exchange data to show that retail has become a more significant portion of markets, especially for some stocks.<sup>5</sup> Using sub-decimal spreads – many retail trades crossing the spread are often filled at sub-decimal prices – Mackintosh noted the following trends seen in Nasdaq’s U.S. Retail Equity Flows (UREF) data:

- Retail value traded per day
  - Gross levels started to increase in December 2019, after most retail brokers reduced commissions to zero
  - In March 2020, levels rose from around \$18 billion to around \$32 billion per day, nearly 2x pre-COVID levels
  - Levels surpassed \$40 billion in April 2020 and January 2021, which some relate to COVID stimulus checks (albeit this does not line up perfectly)
  - Levels ended 2021 still around \$30 billion
- Retail volume (shares) traded per day
  - The increase in volumes is greater than that in value, as retail tends to trade more low-priced stocks
  - Levels increased from around 490 million to over 970 million, with volumes increasing rapidly after COVID lockdowns went into effect
  - During the meme stock trading activity in January 2021, levels jumped to almost 3 billion

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<sup>4</sup> <https://www.sifma.org/wp-content/uploads/2022/03/SIFMA-Insights-Market-Structure-Compendium-February-2023.pdf>

<sup>5</sup> Mackintosh used data from Nasdaq Data Link called U.S. Retail Equity Flows (UREF), which uses a proprietary methodology to capture 45% of retail flow on a stock-by-stock basis. This approach misses retail orders that rest on exchanges as well as orders filled off-exchange at decimal prices

### Financial Advisor Relationship Data

Finally, we look to research from Cerulli Associates to tier retail investors by investable assets. Cerulli defines investor tiers of investable assets as:

- <\$100,000
- **\$100,000 to \$1,000,000**
- \$1,000,000 to \$5,000,000
- >\$5,000,000
- The individual, or commonly thought of as retail, investor is categorized in the \$100,000 to \$1,000,000 tier

Individual investors represent 33 million U.S. households. They hold \$6.5 trillion in assets with securities firms, with an average relationship size of \$135,309. 78% of these investors use a financial advisor (FA) and rely more heavily on the advice of their advisor than their wealthier peers (as shown in the advisor-directed column in the second table).

Asset Tiers	Households (millions)	Advisor Relationships	Assets (billions)	Avg. # Relationships	Avg. Size Relationship
<\$100K	85.8	10.8	82.0	0.1	\$ 7,585.00
\$100K-\$1M	33.0	48.1	6,513.0	1.5	\$ 135,309.00
\$1M-\$5M	7.4	14.8	12,091.0	2.0	\$ 815,672.00
>\$5M	1.6	6.1	9,911.0	3.8	\$1,636,821.00

#### Approach to Investment Advice

Asset Tiers	Using a FA?	Self-Directed	Special Events	Advisor-Assisted	Advisor-Directed
<\$100K	59%	45%	28%	9%	18%
\$100K-\$1M	78%	35%	25%	15%	25%
\$1M-\$5M	83%	33%	27%	19%	21%
>\$5M	83%	33%	30%	23%	14%
All Households	79%	35%	26%	16%	23%

Source: Cerulli Associates

Note: As of 2020. Assets include all retail investor brokerage and advisory assets but not active qualified retirement plan assets. Special event indicates seeking advice around a specific life/monetary event

## What the Regulators Say

Closing out on the non-monolithic theme, there is not one overarching definition for retail investors from regulators. Both FINRA and the SEC have various retail definitions out there, which tend to be tied to an action or particular segment of the market. Some commonly heard definitions include:

- **FINRA, communications** – NASD Rule 2211 defines the term institutional investor to include registered investment companies, insurance companies, banks, registered broker-dealers, registered investment advisers, certain retirement plans, governmental entities, and individual investors and other entities with at least \$50 million in assets. As such, retail investor includes any person other than an institutional investor, regardless of whether the person has an account with a FINRA member firm.
- **SEC, best interest** – Under the SEC’s Regulation Best Interest (Reg BI), the agency defines retail customer as a natural person, or the legal representative of such natural person, who: (a) receives a recommendation of any securities transaction or investment strategy involving securities from a broker-dealer; and (b) uses the recommendation primarily for personal, family, or household purposes.
- **SEC, private placements** – For companies raising capital, the accredited investor definition largely determines who is in their pool of potential investors, and for investors whether they are eligible to invest in many early-stage companies, i.e. private placements. Individuals may qualify as accredited investors based on wealth – net worth >\$1 million excluding primary residence (individually or with spouse) – and income thresholds – income >\$200 thousand individually or >\$300 thousand with spouse in each of the prior two years and an expectation to earn the same in the current year. In 2020, the SEC added financial industry qualifications, including: investment professionals in good standing holding the general securities representative license (Series 7), the investment adviser representative license (Series 65), or the private securities offerings representative license (Series 82); directors, executive officers, or general partners of the company selling the securities; any family client of a family office that qualifies; or knowledgeable employees of a private investment fund.<sup>6</sup>

As mentioned above, there is technically no definition of retail investor in equity market structure. Market participants do have **SEC Rule 605**, which measures execution quality for retail investors based on order characteristics (but excludes odd lots, size improvement, and other statistics). This rule covers only covered orders, <10,000 shares, which have no discretion from the broker. This is typically how retail investors send their orders to brokers.

Exchanges also have definitions which cover retail orders. **Retail Member Organizations (RMO)** are exchange members (or a division of a member) approved to submit retail orders. A retail order is defined as an agency order or riskless principal that meets the criteria of FINRA Rule 5320.03 that originates from a natural person, provided no change is made to the terms of the order with respect to price or side of market and the order does not originate from a trading algorithm or any other computerized methodology. It is an immediate or cancel order and may be an odd lot, round lot, or mixed lot.

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<sup>6</sup> The SEC’s current regulatory agenda includes a planned proposal to redefine accredited investor, with potential restrictions to investors who can participate in certain types of private offerings

## Firm Business Models Are Not Monolithic

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The securities industry employs over 1 million individuals, working at over 35 thousand firms. Given the variety of services offered by securities firms, business models are not monolithic. Differences are driven by business objectives – a firm may choose to specialize in a niche area in which it believes it holds a competitive advantage – and cost constraints – it takes money to build out a new business line (not to mention regulatory requirements for ongoing capital commitment for some areas of business).

These differences provide investors, both institutional and retail, choice. Investors can choose a full-service firm or may prefer a firm specializing in the business segment which serves their needs. What is key is that different business models exist because firms serve different customers with different investment objectives and trading requirements.

As such, not only are business models not monolithic, it would not serve the trading ecosystem or all types of investors to have monolithic business models. In this section, we breakout the universe of firm types and registered representatives.

### **Order Flow: Toxicity**

There is a concept called order flow toxicity, a measure of a market makers'/other liquidity providers' exposure to the risk that counterparties possess informational advantages, which could end in market makers'/other liquidity providers trading at a loss, or in the suboptimal execution of trades in general. On a market level, high levels of toxicity can harm aggregate liquidity and lead to drops in asset prices.

Given this risk, market makers'/other liquidity providers may choose to not interact with certain types of order flow or customers. If all firms were monolithic, these orders or customers might never get served.

### Firm Definitions

Securities firms engage in the business of buying and selling securities – stocks, bonds, mutual funds, exchange-traded funds (ETFs), and certain other investment products – on behalf of its customer (as broker), for its own account (dealer), or both. Before we dive into the data, we provide regulatory definitions for the types of firms discussed later in this report:

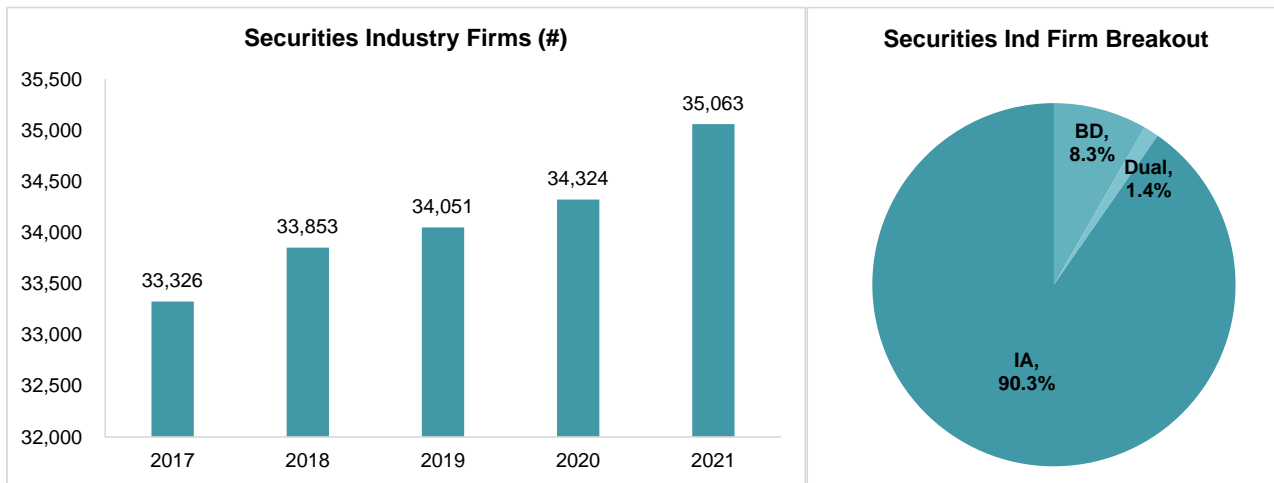
- **Broker** – Acts as an agent on behalf of its clients, putting none of its own capital at risk
- **Dealer** – Acts as a principal, putting its own capital at risk to facilitate transactions
- **Broker-Dealer** – Buys and sells securities on behalf of its clients to enable trading activities and the flow of securities in markets. Some broker-dealers put their own capital at risk to provide the necessary liquidity to keep markets functioning efficiently, i.e. market making. Broker-dealers play many other roles in making capital markets function, including, among others: underwriting securities (capital raising for issuers in the primary markets), publishing investment research, and distributing investment products to clients
- **Investment Adviser** – For compensation, engages in the business of providing investment advice to others about the value of or investing in securities and/or in issuing reports or analyses regarding securities, as part of its regular business

Registered Firms

Total Securities Industry Firms

Securities industry registered firms include all registered firms, whether with FINRA or other regulators (SEC, state agencies). We highlight the following for these firms (as of end 2021):

- 35,063 firms; +2.2% Y/Y, +1.0% 5-year CAGR
- Firm breakout: investment advisor 90.3% of total (31,669 firms, many of which are very small retail financial advisers); broker-dealer 8.3% (2,914 firms); dual registered 1.4% (480 firms)
- Growth rates:
  - Investment advisors growing, with the pace of growth quickening LY; +2.5% Y/Y, +1.4% 5Y CAGR
  - Broker-dealers declining, albeit the pace of the decline lessened LY; -0.5% Y/Y, -1.4% 5Y CAGR
  - Dual registered declining, with the pace of the decline increasing LY; -5.0% Y/Y, -4.2% 5Y CAGR



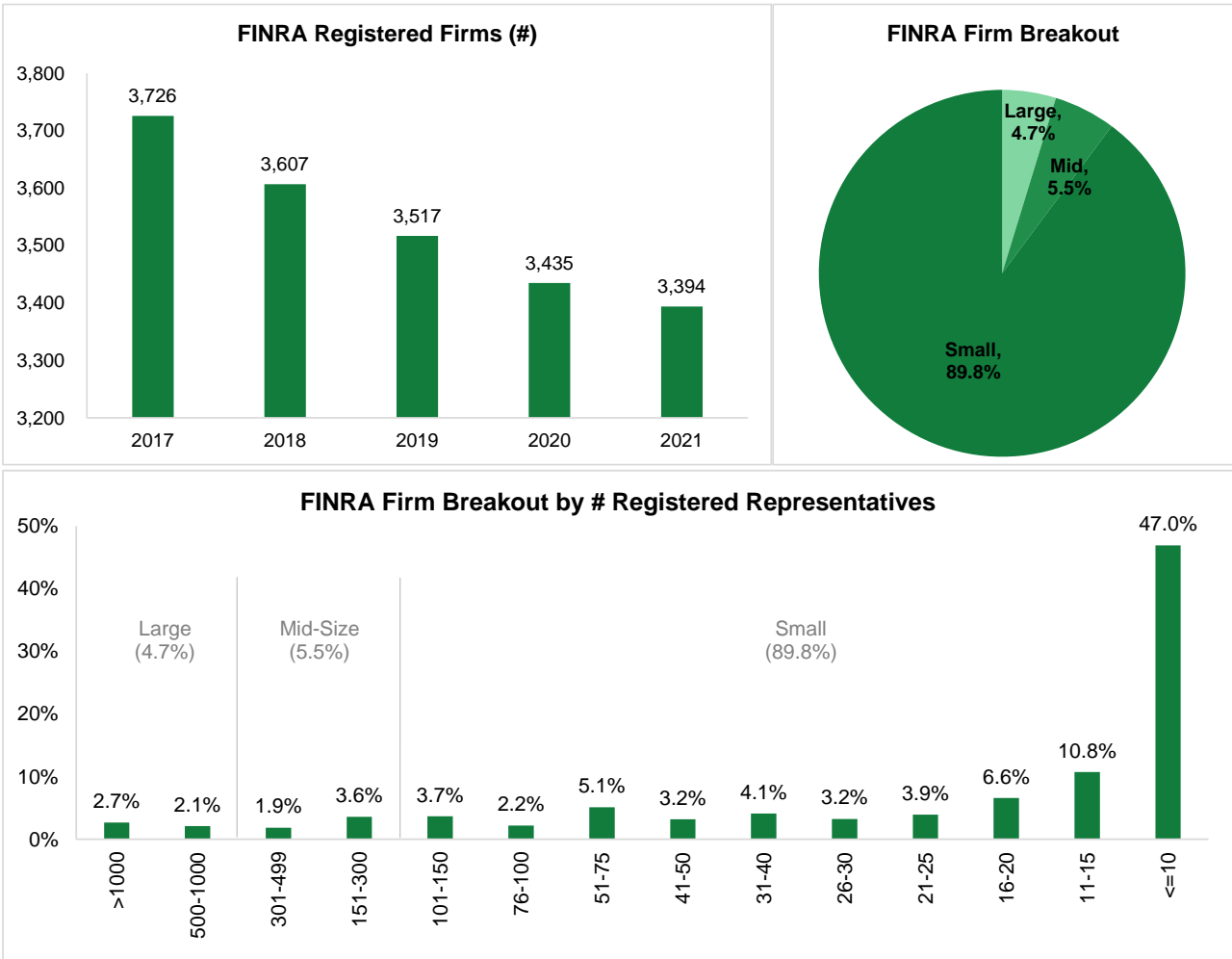
Source: FINRA, SIFMA estimates

Note: Breakout as of 2021. FINRA registered = BD and Dual. BD = broker-dealer = firms solely registered with FINRA as BD; Dual = broker-dealer and investment adviser = FINRA registered broker-dealers also registered as investment adviser firm; IA = investment adviser = firms registered only as investment advisers, overseen by the SEC or state regulators

**FINRA Registered Firms**

Firms conducting securities transactions and business with the investing public must be registered with FINRA, which includes broker-dealers and dual registered firms. We highlight the following for these firms (as of end 2021):

- 3,394 firms; -1.2% Y/Y, -1.8% 5-year CAGR
- Firm breakout: small 89.8% of total (3,048 firms); mid-size 5.5% (185 firms); large 4.7% (161 firms)
- Growth rates:
  - Small firms declining, with the pace of the decline lessening LY; -1.0% Y/Y, -1.9% 5Y CAGR
  - Mid-size firms declining, with the pace of the decline increasing LY; -3.1% Y/Y, -1.0% 5Y CAGR
  - Large firms declining, with the pace of decline increasing somewhat LY; -5.0% Y/Y, -4.2% 5Y CAGR

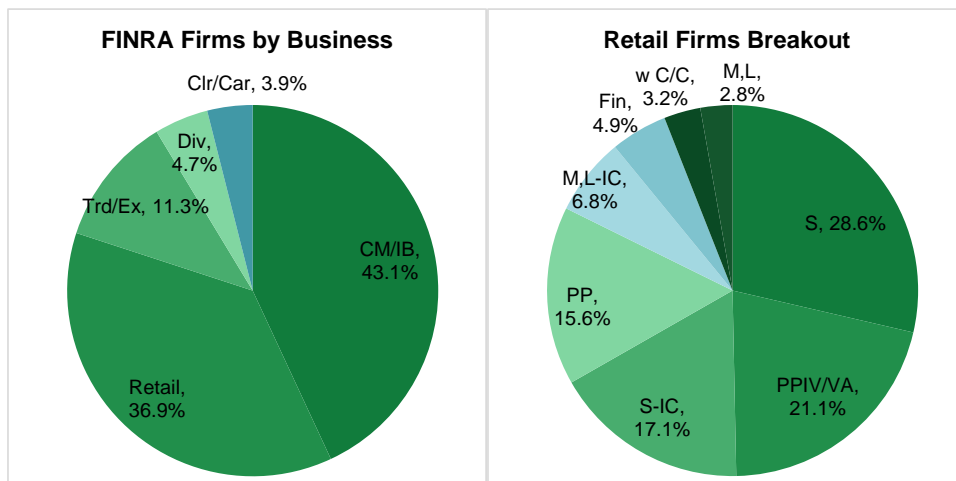


Source: FINRA, SIFMA estimates  
 Note: Breakout as of 2021. Large Firm = 500+ registered representatives; Mid-Size Firm = 151-499 registered representatives; Small Firm = 1-150 registered representatives

**FINRA Registered Firms Breakout by Business Segment**

- Capital markets/investment banking leads at 1,462 firms, 43.1% of total firms; leading subgroup is M&A/investment banking at 49.8% of total CM/IB firms
- Retail follows with 1,254 firms, 36.9% of total firms; top subgroup is small at 28.6% of total retail firms, followed by public pooled investment vehicles (PIV/VA) at 21.1% and small-independent contractor at 17.1%

Group	Sub Group	Firm Count (#)			Total
		Small	Medium	Large	
Capital Markets/Investment Banking (CM/IB) 1,462	M&A/Investment Banking	713	14	1	728
	Private Placements - Institutional Investors	308		1	309
	Product Originator/Wholesaler	203	45	18	266
	Niche/Other - CMIB	113	1		114
	Public Finance	44	1		45
Clearing/Carrying (Clr/Car) 134	Chaperone - 15a-6 Firms	78	1		79
	Securities Financing Book	20			20
	Niche/Other - Clearing	16	1		17
	Correspondent Clearing	13	2	3	18
Diversified (Div) 160	Small Diversified	71	3		74
	Medium Diversified - Carrying/Clearing	14	13	25	52
	Medium Diversified - Non-Carrying/Clearing	7	8	5	20
	Large Diversified	1		13	14
Retail 1,254	Retail Small (S)	357	2		359
	Public Pooled Investment Vehicles/Variable Annuities (PIV/VA)	223	10	31	264
	Retail Small - Independent Contractor (S-IC)	208	6		214
	Private Placements (PP)	192	2	1	195
	Fintech (Fin)	60	1	1	62
	Retail with Carrying/Clearing Activities (w C/C)	30	1	9	40
	Retail Mid-Size & Large - Independent Contractor (M,L-IC)	8	38	39	85
	Retail Mid-Size & Large (M,L)	4	18	13	35
Trading and Execution (Trd/Ex) 384	Institutional Brokerage	256	12		268
	Medium/Small Proprietary Trading/Market Making	51	2		53
	ATS & ECN	49			49
	Large Proprietary Trading/Market Making	9	4	1	14
<b>Total</b>		<b>3,048</b>	<b>185</b>	<b>161</b>	<b>3,394</b>



Source: FINRA, SIFMA estimates

Note: FINRA definition may differ from firm's own definitions. Large Firm = 500+ registered representatives; Mid-Size Firm = 151-499 registered representatives; Small Firm = 1-150 registered representatives. ATS = alternative trading systems, ECN = electronic communication networks

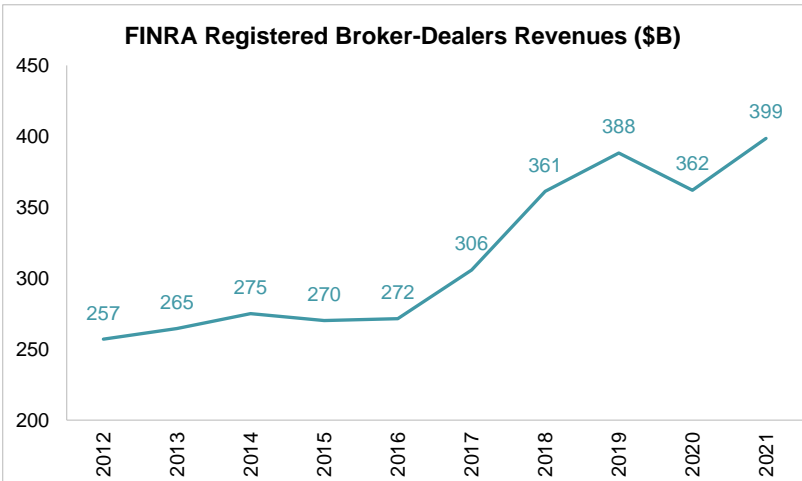


**Revenues for FINRA Registered Broker-Dealers**

Above we showed declining growth rates across the numbers of small, mid-size, and large FINRA registered firms (broker-dealers and dual registered firms). However, we note that total revenues for FIRA registered broker-dealers have steadily increased even as firm numbers declined.

We highlight the following for FINRA registered broker-dealers:

- \$398.6 billion in 2021; +10.1% Y/Y
- Averaged \$363.1 billion over the last five years; 5-Year CAGR 5.4%
- Averaged \$315.3 billion over the last ten years; 10-Year CAGR 4.5%



Source: FINRA Financial and Operational Combined Uniform Single (FOCUS) reports

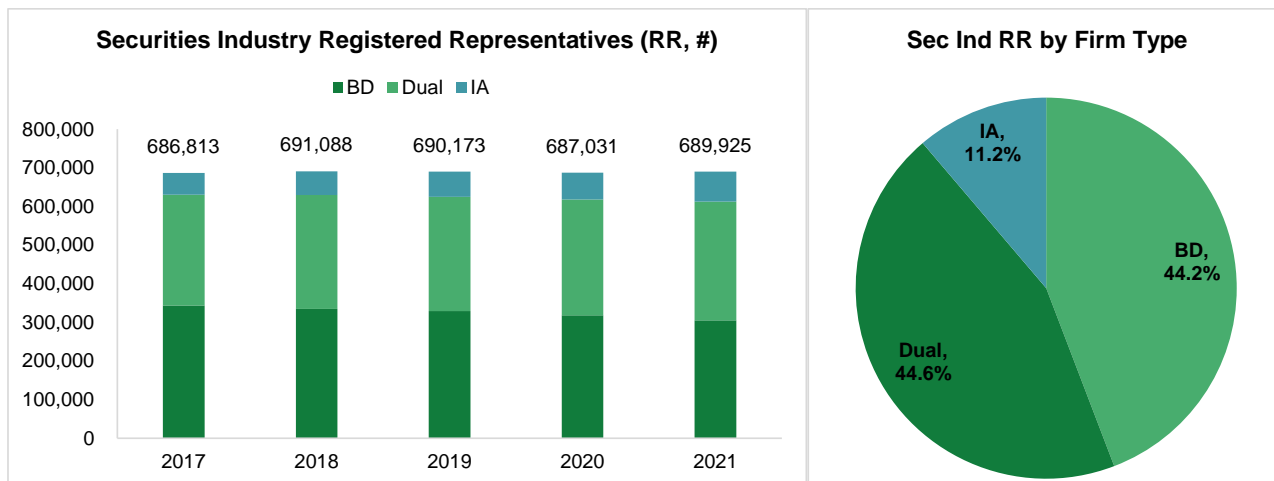
## Registered Representatives (RR)

A registered representative (RR) is an employee engaged in the solicitation or handling of accounts or orders for the purchase or sale of securities, or other similar instruments, for the accounts of customers of his employer or in connection with investment advisory or investment management services furnished on a fee basis by his employer. We highlight the following characteristics of FINRA RRs (as of end 2021):

### Total Securities Industry RRs

Securities industry registered representatives include employees working for all registered firms, whether with FINRA or other regulators (SEC, state agencies). We highlight the following for these RRs (as of end 2021):

- 689,925 RRs; +0.4% Y/Y, +0.1% 5-year CAGR
- RR breakout: dual registered 44.6% (307,590 firms); broker-dealer 44.2% (304,867 firms); investment advisor 11.2% of total (77,468 firms)
- Growth rates:
  - Dual registered RRs increasing, with the pace increasing LY; +2.7% Y/Y, +1.4% 5Y CAGR
  - Broker-dealer RRs declining, with the pace of the decline increasing LY; -4.1% Y/Y, -2.4% 5Y CAGR
  - Investment advisor RRs growing, with the pace of growth quickening LY; +11.5% Y/Y, +6.5% 5Y CAGR



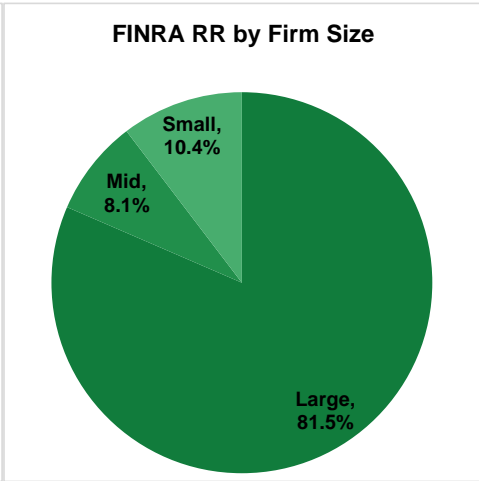
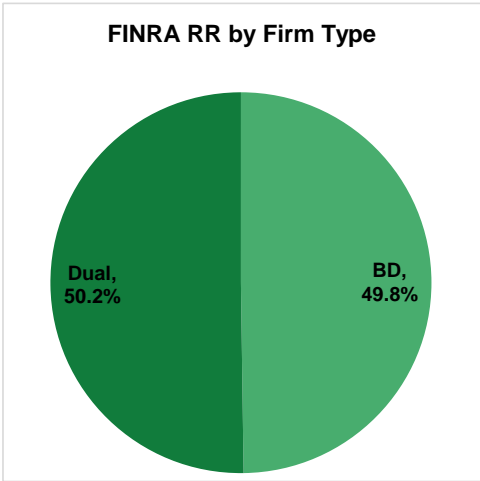
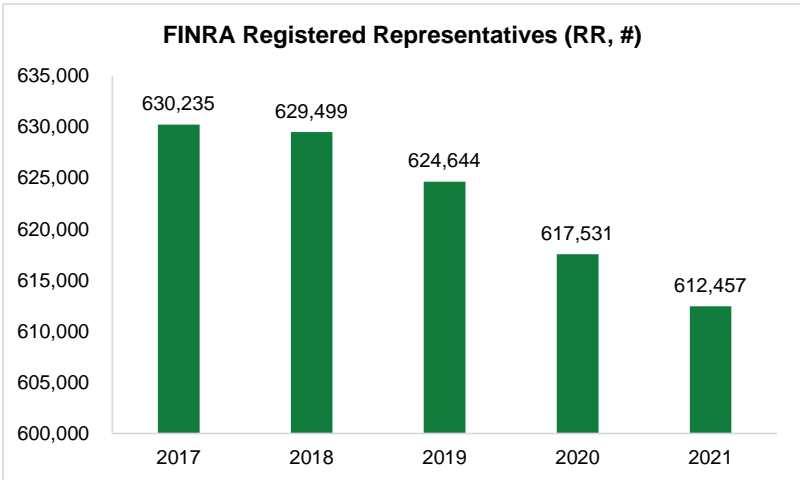
Source: FINRA, SIFMA estimates

Note: Breakout as of 2021. FINRA registered = BD and Dual. BD = broker-dealer = firms solely registered with FINRA as BD; Dual = broker-dealer and investment adviser = FINRA registered broker-dealers also registered as investment adviser firm; IA = investment adviser = firms registered only as investment advisers, overseen by the SEC or state regulators. Individuals are only counted once regardless of how many firms they represent. IA RRs who solely deal with customers in NY, or who were solely dealing with customers in Wyoming prior to 7/1/17, are not captured; IA firm owners are exempt from registering as IA RR and are therefore not included

## FINRA Registered Reps

Firms registered with FINRA include broker-dealers and dual registered firms. We highlight the following for RRs working at these firms (as of end 2021):

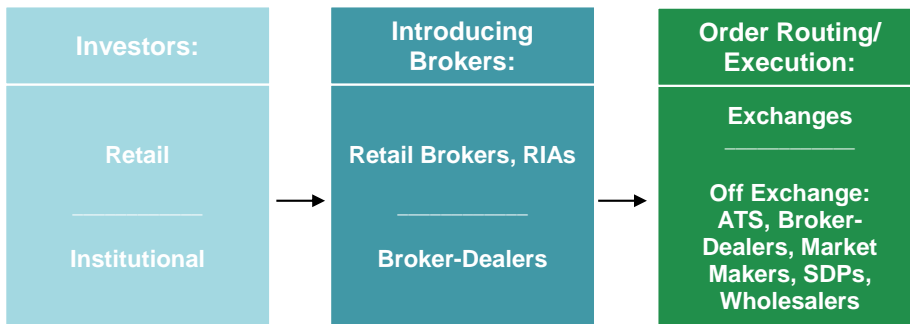
- 612,457 RRs; -0.8% Y/Y, -0.6% 5-year CAGR
- Firm breakout – type:
  - Dual 50.2% (307,590 RRs)
  - Broker-dealer 49.8% (304,867 RRs)
- Growth rates – type:
  - Dual increasing, with the pace of growth increasing LY; +2.7% Y/Y, +1.4% 5Y CAGR
  - Broker-dealer declining, with the pace of the decline increasing LY; -4.1 Y/Y, -2.4% 5Y CAGR
- Firm breakout – size:
  - Large 81.5% of total (510,191 RRs)
  - Small 10.4% (64,864 RRs)
  - Mid-size 8.1% (51,008 RRs)
- Growth rates – size:
  - Large firms declining, with the pace increasing somewhat LY; -0.7% Y/Y, -0.5% 5Y CAGR
  - Small firms mixed but increasing LY; +1.2% Y/Y, -0.5% 5Y CAGR
  - Mid-size firms declining, with the pace increasing LY; -2.8% Y/Y, -0.6% 5Y CAGR



Source: FINRA, SIFMA estimates  
 Note: Breakout as of 2021. BD = broker-dealer = firms solely registered with FINRA as BD; Dual = broker-dealer and investment adviser = FINRA registered BDs also registered as IA firm. Registrations by firm size differ from total registrations as individuals registered with multiple firms are counted for each firm they represent. Large Firm = 500+ RRs; Mid-Size Firm = 151-499 RRs; Small Firm = 1-150 RRs

## Firms in the Equity Trading Ecosystem

The equity order routing process is complex, and labeling firms can be just as complicated. Just as we began this report by saying firm business models are not monolithic, an individual firm may not be monolithic, as it can have multiple businesses. For example, a global investment bank could have a business unit registered as a broker-dealer, a retail broker, a wholesaler, an alternative trading system (ATS), and a market maker. That said, below we define firm types and provide lists on many of the players in the equity trading ecosystem.



Note: ATS= alternative trading system; SDP = single-dealer platform. RIA = registered investment advisor. RIAs have the option to route through their clearing firm or manage their own connections and routing. Most prefer the former given cost constraints and the added regulatory and compliance burdens. That said, they are still responsible for best ex and any regulatory reporting/disclosures (ex: Rule 605).

- **Introducing Brokers**

- Registered Investment Advisors (RIA) – Engage in the business of providing investment advice to others about the value of or investing in securities and/or in issuing reports or analyses regarding securities. Manage the assets of individual and institutional investors.
- Retail Brokers – Facilitate equity trades for their clients, as well as potentially selling additional securities and financial products such as mutual funds, limited partnerships, fixed income, options, and real estate investment trusts. They might advise clients on individual retirement accounts, manage their assets, etc.

- **Off-Exchange Order Routing/Execution**

- Trades by all off-exchange firms/venues are reported to the consolidated tape immediately and contribute to price discovery in real time
- Alternative Trading Systems (ATS) – SEC regulated electronic trading systems operated by broker-dealers that match orders for buyers and sellers of securities, allowing their users to place orders without publicly displaying the size and price of their orders to other participants in the ecosystem.

- Broker-Dealers (BD) – Buy and sell securities on behalf of its institutional clients and retail brokers to enable trading activities and the flow of securities in markets. These firms provide investment advice, supply liquidity through market-making activities, facilitate trading activities, publish investment research, raise capital for companies, and more. FINRA indicates there are 2,914 standalone and 480 dual registered (also registered as an investment advisor) broker-dealers (as of FY21), ranging from small independent firms to large global investment banks.
- Market Makers (MM) – Provide liquidity in securities and execute trades both on and off national securities exchanges, actively quoting two-sided markets in a stock, providing bids (buys) and asks (sells). Market makers provide liquidity for all exchange listed stocks in which they make a market, committing their own capital to enable transactions and maintaining an inventory of the stocks in which they make a market. Market makers are often broker-dealers.
- Single-Dealer Platforms (SDP) – An electronic trading platform operated by a broker-dealer where the firm itself acts as the principal counterparty for every transaction. Unlike an ATS, where subscribers' orders to buy and sell are matched with one another by the ATS, on an SDP, the broker-dealer operating the SDP is always the counterparty to any trade that occurs on the SDP.
- Wholesalers – Broker-dealer that acts as a market maker for other broker-dealers. Some broker-dealers, especially retail broker-dealers, route all or a significant portion of their orders to one or more wholesalers. A wholesaler's business is to execute those orders, which may involve executing the orders itself or further routing to other venues. Wholesalers provide a suite of services to their clients, particularly retail brokers. This includes, importantly, the assumption of the best execution obligation. Additionally, wholesalers have the ability to internalize order flow – the practice of matching orders internally on their own trading desks – enabling them to improve upon execution offered directly on exchange. Finally, wholesalers compete with each other to execute retail broker orders and are judged on their execution quality. If one wholesaler does not provide good execution for a retail broker's orders, it will be replaced with another wholesaler which provides better execution for that retail brokers' orders.

### Order Routing/Execution

When routing and executing trades, firms and venues can act either as a principal or non-principal (agent) participant:

- Principal - provide liquidity on and off exchange (broker-dealers, market makers, single-dealer platforms, and wholesalers)
- Non Principal –
  - Match buy and sell orders (alternative-trading systems, exchanges)
  - Offer algos and routers to handle and fill clients' orders (agent broker-dealers, wholesalers)

## Retail Brokers

- Ally Invest
- Apex
- Charles Schwab
- E\*TRADE from Morgan Stanley
- Fidelity Brokerage
- Interactive Brokers
- Robinhood
- Tastyworks
- TD Ameritrade, includes TD Ameritrade Clearing; part of Charles Schwab
- TradeStation, a subsidiary of the Monex Group
- WeBull

Source: SEC Rule 606 filings, as compiled by Bloomberg Intelligence (as of December 2022)

## Broker-Dealers

- Bank of America
- Barclays
- BNP Paribas
- Citadel Securities
- Citigroup
- Credit Suisse
- Deutsche Bank
- Goldman Sachs
- HSBC
- JP Morgan
- Morgan Stanley
- Société Générale
- Susquehanna
- UBS
- Wells Fargo
- Virtu Financial

Note: Not an all-inclusive list

### **Market Makers**

- Bank of America
- Citadel Securities
- G1 Execution Services/Susquehanna
- Jane Street
- JP Morgan
- Hudson River Trading
- Morgan Stanley
- Two Sigma Securities
- UBS
- Virtu Financial

Source: SEC Rule 605 filings, as compiled by Bloomberg Intelligence (as of January 2023)

### **Wholesalers**

- Citadel Securities
- G1 Execution Services/Susquehanna
- Jane Street
- Hudson River Trading
- StoneX
- Two Sigma Securities
- UBS
- Virtu Financial

Source: SEC Rule 606 filings, as compiled by Bloomberg Intelligence (as of December 2022)

Note: Includes currently active firms, i.e. firms with dollar amounts reported in 2022. Prior firms include (exited the business, etc.): Instinet/BlockCross, Interactive Brokers, National Financial, Apex Clearing, Canaccord Capital, GTS Securities, Goldman Sachs, Wolverine, XTX Markets



## Equity Alternative Trading Systems (ATS)

- BIDS ATS
- BNPP CORTEX ATS
- BOATS
- CBX
- CITI-ONE ATS
- CODA
- CROSSFINDER
- CROSSSTREAM
- DEALERWEB
- IBKR ATS
- IBKR EOS ATS
- INSTINCT X
- INSTINET BLOCKCROSS
- INTELLIGENT CROSS LLC
- JPB-X
- JPM-X
- LEVEL ATS
- LIQUIDNET H2O ATS
- LIQUIDNET NEGOTIATION ATS
- LUMINEX ATS
- MS POOL (ATS-4)
- MS RPOOL (ATS-6)
- MS TRAJECTORY CROSS (ATS-1)
- ONECHRONOS
- POSIT
- PURESTREAM
- SIGMA X2
- STIFEL X
- THE BARCLAYS ATS
- UBS ATS
- VIRTU MATCHIT ATS
- XE

Source: FINRA (as of 4Q22)

Note: Not an all-inclusive list

## Equities Not Equal to Listed Options

As 92.5% of the listed options traded today are in equity contracts (versus equity index, as of FY22), it is understandable why many people view the equities and listed options markets as similar if not the same. However, the equities markets operate differently from the listed options markets. In fact, the SEC acknowledged this in their final rule for the 2018 transaction fee pilot, stating “options and equities are materially different types of securities.”

In this section, we analyze the following differences between equities and options:

Factor	Equities	Listed Options
Product Type	Stocks, ETPs	Derivatives
# of Securities	~8,300	~1,500,000
Trading Venues	16 exchanges Off exchange*: 32 ATS, >200 OTC	16 exchanges Off exchange*: none
Market Type	Order driven	Quote driven
Auctions	Open, close, IPO, & reopen auctions; few periodic auction ex's	Retail price improvement mechanisms

Note: ETP = exchange-traded product, predominantly exchange-traded funds (ETF). Equities would be >11K if include mutual funds, closed-end funds/CLEFs, etc. options strikes estimated by market participants. BOX's approval to open equity exchange BSTX will make 17 equity exchanges (not yet trading). MEMX's approval to open a listed options exchange will make 17 options exchanges (not yet trading).

\*While the technical definition of over-the-counter (OTC) trading refers to any transaction conducted directly between two parties, without the supervision of an exchange, here we use off exchange trading to refer to a type of OTC trading where the trades are reported to the consolidated tape (similar to on-exchange trading) – this occurs in equities but not options, although there is OTC trading in options

### Product Type

Equities are stocks (operating companies and real estate investment trusts/REITs), exchange-traded products (ETPs<sup>7</sup>), and other equity like products (mutual funds, closed-end funds/CLEFs, etc.). Stocks are securities representing the ownership of a fraction of an operating company.

Listed options are derivatives. An option is a contract to buy or sell an underlying asset or security (stocks, ETFs, etc.) at a specified price on or before a given expiration date. With an equity option, the contract holder (buyer) has the right to buy/sell (if a call/put) shares of the underlying stock. The writer (seller) of an option is obligated to sell/buy (if call/put) the shares to/from the buyer of the option at the specified price upon the buyer's request.

A key difference between the two securities is ownership – a stock provides partial ownership of a company, an options contract itself does not. As such, the investment decisions behind the two types of securities differ. Investors buy stocks to invest outright in a company, based on fundamentals – valuation, they like the company's business model, it is a key player in a market theme such as electric vehicles, etc. Options, however, are often purchased to provide risk management for an investment portfolio, or to arrange to buy a stock at a set lower price in the future.

<sup>7</sup> Pooled investment vehicles which trade intraday on exchanges and other trading venues, with prices typically based on the underlying securities' prices. Types = exchange-traded funds (ETFs, holding an underlying basket of equities, bonds, commodities, currencies, or hybrid of) and exchange-traded notes (ETNs, structured investment products issued as senior unsecured debt notes and backed by the creditworthiness of their issuer.

### # of Securities

At the writing of this report, there were 8,344 securities actively trading on U.S. equity exchanges today. This consists of 5,221 stocks (operating companies and REITs) and 3,123 exchange-traded funds (ETFs). (The number would be over 11,000 if included mutual funds, closed-end funds/CLEFs, etc.)

On the listed options side, market participants estimate there are around 1.5 million strikes. The strike is the price at which the contract may be exercised or acted on (buy/sell the underlying stock). As such, a single stock or index option will have multiple strike prices for both the call and the put contract for each different expiration date. For example, on one day, the popular SPDR S&P 500 ETF TRUST (SPY, \$359.0 billion AUM) had 258 strikes for a single contract alone. As such, the listing of options securities across all strikes is magnitudes of stocks – around 1.5 million tradable securities in options versus only around 8,300 in equities.

## Trading Venues

Exchanges offer a range of trading, pricing, and market models, targeting different areas of the market to meet the varied needs of market participants.

- **Trading models:** While today's exchanges utilize advanced technologies, some mix in human interaction to facilitate trading efficiencies, i.e. a hybrid model. A well-known example is the NYSE closing auction, blending technology and human judgment to produce the closing price for stocks.
  - Electronic trading model – all orders are executed electronically, replicating as much as possible the function of the floor broker
  - Hybrid – orders are executed by a mixture of open outcry on trading floors and electronic methods
- **Pricing models:** Pricing models are often based on the provision or usage of liquidity. The maker-taker models pay a transaction rebate to market makers providing liquidity (makers) and charge a transaction fee to market participants taking out liquidity (takers). Makers post buy and sell offers and are paid a fee, around \$0.20-\$0.30 for every 100 shares traded. Takers are charged a fee. Exchanges utilizing the taker-maker model are in the minority but do offer another market structure option for market participants. Exchanges may also pay market participants rebates, or marketing fees (in options) to route customer order flow to an exchange.
  - Maker-Taker – charges customers who remove liquidity from the exchange while providing rebates to traders who provide liquidity
  - Taker-Maker – charges customers who provide liquidity to the exchange while providing rebates to traders who remove liquidity
  - Traditional (options only) – frequently used by retail-oriented options firms. Order flow providing firms are paid for orders sent to exchanges with traditional pricing models. Customers trade free and are given execution priority over market makers and proprietary trading firms
- **Market Models:** Matching orders is the process of pairing opposite buy (bid)/sell (ask) requests for a stock submitted in close proximity of price and time. If, for the same quantity of a stock, the maximum bid matches or exceeds the minimum ask, orders are matched and the transaction is made. Most exchanges match orders on a price-time priority basis. The earliest and best active buy order (highest price) is matched with the best sell order (lowest price). If the prices quoted are the same and both the orders are the same type (buy/sell), then whoever placed the order earlier will have the higher priority when the orders are filled (in rare cases where time and price are the same, exchanges will often prioritize larger orders).

Or, if all transaction conditions are the same, exchanges can match active orders on a pro rata basis, i.e. the shares are split among the orders proportional to the relative size of each order. Here, as in options auctions, an order may end up filled, partially filled, or unfilled. If an order loses priority, it can be re-requested by changing the quantity, price, or account type. In equities, this only occurs on the NYSE exchange, since electronic models do not have pro-rata allocation.

- Price-Time priority – orders at each price point are filled in timestamp order. Ex: An active buy order for 250 shares of stock at \$85 per share precedes (is placed before) an order for 50 shares of the same stock at the same price; the system matches the entire 250 share order before matching any part of the 50 share order
- Pro-Rata – incoming orders are allocated to liquidity providers based on the size of their quotes and not on their place in the queue. Ex: There are two active buy orders, 250 shares and 50 shares at \$85; if a 240 share sell order comes in, the system matches 200 shares and 40 shares respectively to the two buy orders (80% of each order is filled)
- Pro-Rata/Customer Priority (options only) – Pro-rata combined with a market model that provides customers execution priority over other participants

## Equity Exchanges

Looking at company websites and SEC documentation, we estimate that the 16 U.S. equities exchanges can be classified as:

Parent Company	Exchange	Trading Model	Pricing Model	Market Model
NYSE	Arca	Electronic	Maker-Taker	Price-Time
	American	Electronic	Flat Fee	Price-Time
	NYSE	Hybrid*	Maker-Taker	Parity Allocation**
	National	Electronic	Taker-Maker	Price-Time
	Chicago	Electronic	Maker-Taker	Price-Time
Nasdaq	Nasdaq	Electronic	Maker-Taker	Price-Time
	PHLX	Electronic	Maker-Taker	Price-Time
	BX	Electronic	Taker-Maker	Price-Time
Cboe	EDGX	Electronic	Maker-Taker	Price-Time
	BZX	Electronic	Maker-Taker	Price-Time
	EDGA	Electronic	Taker-Maker	Price-Time
	BYX	Electronic	Taker-Maker	Price-Time
MIAX	Pearl	Electronic	Maker-Taker	Price-Time
Other	MEMX	Electronic	Maker-Taker	Price-Time
	IEX	Electronic	Flat Fee*	Speed-Bump
	LTSE	Electronic	Maker-Taker	Price-Time

Source: Company websites, SEC documentation, SIFMA estimates

Note: \*NYSE = technology + human judgment; electronic order flow, DMs (designated market makers), & floor brokers. \*\*Only for floor, not upstairs trading. Arca = exchange-traded products. American = small cap companies. Chicago = supports institutional brokers trading exchange-traded derivatives. IEX labelled in SEC documentation as flat fee, we consider it a maker-maker model; speed bump imposes delays to protect from trading at stale prices

## Options Exchanges

According to The Options Industry Council, the education arm of the Options Clearing Corporation, the 16 U.S. multi-listed options exchanges can be classified as:

Parent Company	Exchange	Trading Model	Pricing Model	Market Model
NYSE	Arca	Hybrid	Maker-Taker/Traditional	Price-Time
	American	Hybrid	Traditional	Pro-Rata
Nasdaq	Nasdaq	Electronic	Maker-Taker	Price-Time (anonymous)
	PHLX	Hybrid	Maker-Taker/Traditional	Pro-Rata/Customer Priority
	BX	Electronic	Taker-Maker	Price-Time & Pro-Rata/Customer Priority
	ISE	Electronic	Maker-Taker/Traditional	Pro-Rata/Customer Priority
	GEMX	Electronic	Maker-Taker	Pro-Rata/Customer Priority
	MRX	Hybrid	Traditional	Pro-Rata/Customer Priority
Cboe	EDGX	Electronic	Traditional	Pro-Rata
	BZX	Electronic	Maker-Taker	Price-Time
	Cboe	Hybrid	Traditional; incentives to high volume traders	Pro-Rata
	C2	Electronic	Maker-Taker	Pro-Rata
MIAX	MIAX	Electronic	Traditional	Pro-Rata/Customer Priority
	Pearl	Electronic	Maker-Taker	Price-Time
	Emerald	Electronic	Maker-Taker	Pro-Rata/Customer Priority
Other	BOX	Hybrid	Traditional	Price-Time

Source: The Options Industry Council

## Compare & Contrast

Both equities and multi-listed options currently have 16 exchanges<sup>8</sup>. However, they are not all the same exchanges. As shown below, only 8 of the 16 exchanges currently operate in both the equities and options markets. Additionally, the shared exchanges post different market shares across asset classes. For example, Nasdaq PHLX has a 10.8% share in listed options (rank #3) versus a 0.9% share in equities (rank #11).

		Equities		Options	
Exchange Count		16		16	
Parent Co	Exchange	Operating?	Market Share	Operating?	Market Share
NYSE	NYSE	X	9.9%		
	Arca	X	8.4%	X	11.8%
	National	X	0.8%		
	American	X	0.5%	X	7.3%
	Chicago	X	0.3%		
Nasdaq	Nasdaq	X	16.2%	X	6.4%
	PHLX	X	0.8%	X	10.3%
	BX	X	0.5%	X	3.0%
	ISE			X	5.3%
	GEMX			X	1.8%
	MRX			X	1.5%
Cboe	EDGX	X	5.6%	X	5.8%
	BZX	X	5.2%	X	5.1%
	EDGA	X	1.5%		
	BYX	X	1.3%		
	Cboe			X	16.8%
	C2			X	4.1%
MIAX	MIAX			X	6.1%
	Pearl	X	1.0%	X	6.2%
	Emerald			X	2.8%
Other	MEMX	X	3.5%		
	IEX	X	2.5%		
	LTSE	X	0.001%		
	BOX			X	5.7%
Off-Exchange Trading*		X	41.9%		n/a

Source: Cboe Global Markets, SIFMA estimates (as of FY22)

Note: BOX approved to open an equity exchange, not yet trading. MEMX approved to open an options exchange, not yet trading. Here we define off-exchange trading as over-the-counter trading where the trades are reported to the consolidated tape. There is OTC trading in options, but not reported to the tape

<sup>8</sup> BOX approved to open an equity exchange, MEMX approved to open a listed options exchange (neither trading yet)



A key difference between equities and options is that there is no off-exchange trading in options. While the technical definition of over-the-counter (OTC) trading refers to any transaction conducted directly between two parties, without the supervision of an exchange, here we use off exchange trading to refer to a type of OTC trading where the trades are reported to the consolidated tape (similar to on-exchange trading). This occurs in equities but not options, although there is OTC trading in options.

In equities, off-exchange trading ranged from 33.3% to 47.0% of total trading volume throughout 2022, ending the full year at 41.9% on average. In other reports on equity market structure, we go into more detail on order routing in equities, but in general the off-exchange trading market structure involves a robust group of venues and market participants, including: 32 alternative trading systems (ATS) and over 200 over-the-counter (OTC) trading venues; market makers, wholesalers, and other liquidity providers.<sup>9</sup>

As discussed above, there is no off-exchange trading in listed options markets where the trades are reported to the consolidated tape. As such, there are no trade reporting facilities (TRF) in options as there are in equities. TRFs provide a mechanism for reporting off-exchange transactions to the consolidated tape. While affiliated with an exchange (two operated by Nasdaq, one by NYSE), each TRF is a FINRA facility subject to registration as a national securities association.

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<sup>9</sup> Off exchange market centers provide services other than trading, and trades are not subject to each exchange's limitation of liability policy

### Market Type

**Order-Driven:** Equities operate in an order-driven market. In this type of market, all buyers and sellers display the prices at which they wish to buy or sell a particular security, as well as the amounts of the security desired to be bought or sold. There are two basic types of orders: market orders and limit orders. A market order is an order to buy or sell a stock at the prevailing best available price. It typically ensures execution but does not guarantee a specified price. A limit order is an order to buy or sell a stock with a restriction on the maximum price paid if buying or minimum price received if selling, i.e. the limit price. It ensures price, at the specified limit or better, but does not guarantee execution.<sup>10</sup>

**Quote-Driven:** Options operate in a quote-driven market, also known as a price-driven market. In this type of market, prices are determined from bid and ask quotations made by market makers, dealers, and specialists. (We note that almost all retail orders trade in auctions. Exchanges typically provide quote width relief, meaning quote spreads can be wide in many names.) Here, dealers fill orders from their own inventory<sup>11</sup> or by matching them with other orders – they supply all of the liquidity. This leads to the need for significant risk mitigation – 16 exchanges times 1.5 million strikes equals 24 million – including managing wider spreads.

A quote-driven market is the opposite of an order-driven market, which displays individual investors' and other market participants' bid and ask prices and the number of shares they are willing to trade. In other words, quote-driven trades are determined by those who make the markets, rather than by the investors. In this type of market, market makers and other liquidity providers provide a significant amount of displayed liquidity.

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<sup>10</sup> Limit orders are subject to the order protection rule; while not guaranteeing execution, it prevents the order from being traded through on any exchange

<sup>11</sup> Market makers can short/hedge positions and don't always have the inventory on hand to match orders

### Auctions

Theoretically, auctions are defined as places where buyers and sellers enter competitive bids simultaneously. The price at which a product trades represents the highest price that a buyer is willing to pay and the lowest price that a seller is willing to receive. However, structuring an auction is incredibly complex, making it difficult to determine a single definition for an auction. There are multiple different directions to take to build one, each of which will bring very different outcomes.

In today's multi-listed options markets, the auction begins with a consolidator bringing a paired order to the exchange – which guarantees the retail customer an execution – prior to the auction opening up for competitive bids. The price that the investor receives is no worse than the price that was entered on the paired order.

In equities, there are auctions in place today. Equity markets have opening, closing, IPO, and reopening auctions; for example the NYSE closing auction is used to close the trading day and determine closing prices for securities. Exchanges could offer retail auctions if they chose to. Several exchanges – NYSE, Nasdaq, CBOE, etc. – offer Retail Liquidity Programs (RLP) in efforts to compete for retail order flow. These programs offer marketable<sup>12</sup> retail orders price improvement opportunities on exchange. For example, at NYSE, they publish indicators on market data feeds indicating when there is liquidity on the buy-side, sell-side, or both, increasing the likelihood of a fill. In general, these programs have not been as successful as exchanges would have hoped, given the service model offered by order routing/execution firms – bespoke price improvement, adjustments for disputed executions, etc. Additionally, some exchanges run periodic auctions; for example, Cboe runs an auction on its BYX exchange.

The SEC has proposed that auctions be expanded for retail orders that do not receive midpoint execution. This suggestion brings up complex risk management and operational questions for market participants.

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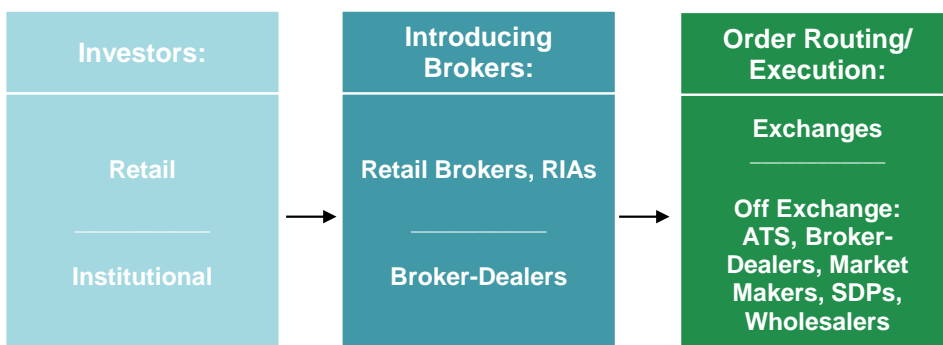
<sup>12</sup> A buy order is marketable if the buy price is greater than or equal to the NBBO; a sell order is marketable if the sell price is less than or equal to the NBBO. Market orders are always considered marketable – market orders are transactions meant to execute as quickly as possible at the current market price, whereas limit orders set the maximum or minimum price at which a participant is willing to buy or sell

## Roles and Responsibilities?

This feeds into the question of the roles and responsibilities for market participants across the equity trading ecosystem. An order can flow through the ecosystem in a variety of paths. Regardless of how an order flows across the marketplace, what is clear is that the order handling responsibilities of the broker who originally receives an investor's order ensures the execution of that order.

This is where the simplicity ends. Once the investor places the order, as shown in the diagram below, flow moves across the buckets, with varying rolls and responsibilities for the firms within those buckets:

1. **Investors:** Retail or institutional; vary in investment objectives
2. **Introducing Brokers:** Retail brokers service retail investors, broker-dealers service institutional investors or other broker-dealers. They are responsible for trade execution, regardless of the remaining path the trade takes. Their responsibility is to meet their clients' objectives by providing the most seamless and cost-efficient execution quality for every trade and are constantly judged on execution performance by their clients, the investors.
3. **Order Routing/Execution:** Exchanges or off-exchange venues. Order routing firms are evaluated on execution quality by their clients, the introducing brokers. If they do not perform to expectations – and, again, brokers are looking to meet best execution requirements (as required by FINRA) for their clients, the investors – they will be replaced with another firm. The role of execution venues is to match orders unless they are required to seek liquidity elsewhere. In the case of exchanges, these entities are governed by rules and do not actively intervene to eliminate bad experiences for investors. For example, trade errors can actually print to the tape. Other execution venues will have more flexibility to handle multiple order types, depending upon the venue type and the corresponding regulations (ex: Regulation ATS) for that type of venue.



Note: ATS= alternative trading system; SDP = single-dealer platform. RIA = registered investment advisor. RIAs have the option to route through their clearing firm or manage their own connections and routing. Most prefer the former given cost constraints and the added regulatory and compliance burdens. That said, they are still responsible for best ex and any regulatory reporting/disclosures (ex: Rule 605).

Investors care about getting the best price on their trade, but the overall trading experience is also important to keeping them engaged. As such, the above diagram understates the benefits provided indirectly or directly to investors once a trade is placed. Some off-exchange venues provide guaranteed trade execution to introducing brokers – and therefore indirectly to investors – consistent with the introducing broker’s best execution objectives. And introducing brokers directly guarantee trade execution to investors, in line with their investment objectives.

However, these firms provide clients with a suite of services beyond trade execution. Executing broker-dealers take on the cost and responsibility of being exchange members, connecting to all sixteen exchanges, which can be prohibitive for some introducing brokers. They also perform risk management services for clients’ portfolios. And, importantly, wholesalers assume the best execution obligation from retail brokers.

Without these actions, introducing brokers, particularly retail brokers but also smaller broker-dealers, would have to take on this expense, the risk, and the full liability for trade execution themselves. Additionally, introducing brokers’ roles also involve maximizing the investor’s trading experience on a consistent basis. Retail brokers, for example, provide investor education and portfolio construction tutorials for customers. These firms also offer help desk functionality for their clients, among other services.

In general, responsibilities for firms go beyond the trade to include the totality of the client experience, rolling all the way down to the end user, investors.

### **What could be the impact on market integrity and ultimately investors?**

Another question is about the impact for market structure and investors. Today’s equities market structure – which segments retail flow – is highly competitive. The structure is set up to collectively serve this constituent. Currently, the system serves all orders in this group, none are left behind. Conversely, order-by-order competition as proposed by the SEC enables market participants to select the orders with which they want to transact. This could leave some retail orders untouched, destroying liquidity on orders where wholesalers currently compete today.

This could have negative impacts on investors. Decreasing liquidity increases spreads and therefore costs to trade. Lack of segmentation could decrease the level of price improvement currently provided to investors (averaging over \$3.5 billion per annum the last few years).

#### **Order Flow: Segmentation**

Segmentation is the ability of different venues to select who they trade with, segmenting that flow away from the rest of the market. Academics classify traders as informed – most likely to cause adverse selection, where prices change permanently – and uninformed. In a competitive market, uninformed traders should receive lower effective spreads, commensurate with their lower toxicity (discussed earlier in this report).

Summarizing various academic papers, most find that off-exchange trades do have a lower adverse selection, indicating that segmentation works (for some liquidity providers). Some academics also find lower effective spreads, indicating that segmentation also helps investors who qualify for the segment. In the case of equity trading, qualifying parties would be retail investors.

Source: Phil Mackintosh, Chief Economist at Nasdaq

Depending upon what gets included in the SEC's final rule – if they do actually require auctions for certain retail orders – switching to order-by-order competition via an auction is anticipated to remove any economic rent currently in existence. It has been commented that removing economic rents would be a positive. In the case of equity trading, the non-produced inputs in economic rents are the services offered by order routing/execution firms and introducing brokers, as discussed above: guaranteed trade execution, i.e. taking on full liability for trade execution; costs and responsibilities associated with exchange membership; risk management services for clients' portfolios; and generally maximizing the investor's trading experience on a consistent basis (investor education, help desks, etc.). This service business model benefits investors, and removing it, by labeling it a negative as an economic rent, would not be considered a positive. Additionally, economic studies indicate that economic rents cannot be eliminated by competition.

Another concern is that the auction structure could have a reverse impact on competition. Not all firms in the equity trading ecosystem will be open to interacting with all orders – as discussed in the toxicity discussion earlier in the report – contrasting with the current market structure. Negatively shifting the economics of a trading ecosystem could, in actuality, lead to a decrease in the number of market participants (market makers, wholesalers). This would, therefore, increase concentration at the expense of competition.

Given all of these factors, market participants could be charged for auction participation, versus today's low-cost execution environment. And, importantly, there is no assurance a retail order will be executed in the auction.

### **Economic Rents**

In economics, economic rent is any payment to an owner or factor of production in excess of the costs needed to bring that factor into production. In classical economics, economic rent is any payment made or benefit received for non-produced inputs such as location (ex: land) and for assets formed by creating official privilege over natural opportunities (ex: patents). In the moral economy of neoclassical economics, it can be loosely defined as the amount of money earned exceeding that which is economically or socially necessary.

Economic rent is not to be confused with producer surplus or normal profit, the later of which involve productive human action and arise in the course of competitive capitalist production. Economic rent is also independent of opportunity cost, unlike economic profit where opportunity cost is an essential component. Economic rent is viewed as unearned revenue, whereas economic profit describes surplus income greater than the next best risk-adjusted alternative.

Unlike economic profit, economic rent cannot be theoretically eliminated by competition since all value from non-produced inputs yields economic rent.

Source: Boston University academic website

## Cash Flows across the Trading Ecosystem

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In any business, cash flows across participants throughout the supply chain before reaching consumers, from production to venue where the sale will be made. In economics, you can apply several formulas for revenues and costs – price times quantity, summing fixed and variable costs, etc. – to analyze cash flows across an industry. In equity markets, the key equation is total trade costs, which is calculated as:

### Trade Costs = $\Sigma$ (Explicit Costs + Implicit Costs)

- **Explicit** – broker or dealer commissions, access/connectivity and data fees, exchange membership fees, transaction costs, clearing and settlement costs, taxes (including Section 31 fees)
- **Implicit** – bid-ask spreads, opportunity costs<sup>13</sup>, price impact of a trade<sup>14</sup>, etc.

The cash flows making up this equation create revenues and costs for the different market participants across the trading supply chain. On the institutional side of equity trading, broker-dealers charge institutional clients commissions for performing trading services. Similar payment arrangements are made on the asset management side of the business, where these firms charge fees for managing client portfolios, based on assets under management. The workflow around buying stocks (or ETFs) is no different than in manufacturing. Various market participants provide essential services to the flow of goods, and payments are made to these firms for their services in the process – the supply chain in manufacturing, the trading ecosystem in equities. These payments represent costs for the payer and revenues to the payee.

This is where the similarities end between equity trading and manufacturing. The market structure in equities is set up to provide consumers, i.e. investors, with a zero or low commission trading environment. We cannot say Louis Vuitton offers its consumers the same benefit.

In this section of the report, we analyze the cash flows across market participants – prior to reaching investors – in the U.S. equity trading ecosystem.

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<sup>13</sup> The loss of potential gain on other alternatives when one alternative is chosen

<sup>14</sup> Trade price deviates from current market price as a result of the trade; impacts future trades or the final fulfillment of the full share quantity of the original trade if that trade was executed in segments

### Defining Cash Flows

Below we define the cash flows across the equity trading ecosystem, positioning them from the expense side of the income statement for the various market participants. Naturally, each cost paid by the payer will have a corresponding revenue account for the payee.

#### Transaction-Based Expenses: Paid by Order Routing/(Non Exchange) Execution Firms

- **Access Fees** – Order routing/execution firms pay exchanges fees to access quotes on its market. SEC Rule 610 sets standards governing access to quotations in NMS stocks, limiting fees exchanges can charge for accessing protected quotes to no more than \$0.003 per share. (Additionally, alternative trading systems/ATS may charge customers commissions for accessing their platform.)
- **Market Data** – Market data includes order and trade associated details such as prices, bid/ask quotes, and volumes, as provided by trading venues. Trading firms use this data for real time decision making, i.e. whether to buy or sell the stock (historical data can be used to analyze trends and estimate portfolio risks). Market makers and other liquidity providers also use the data to make markets and place orders on behalf of clients. All equity trades are reported to the consolidated tape, an electronic system reporting the latest price and volume data, as well as the national best bid offer (NBBO), on transactions of exchange listed stocks. All firms pay for access to this data. Firms must purchase additional data sets to get more detailed trade details, i.e. depth of book, which is only available on exchanges' proprietary data feeds.<sup>15</sup> Firms must purchase market data to verify they are meeting best execution regulatory obligations. Under the vendor display obligation, all investors must have access to current market data.
- **Payment for Order Flow (PFOF)** – In off-exchange trading<sup>16</sup>, wholesalers may offer payments – typically fractions of a penny per share – to some retail brokers for the right to trade with its customer order flow. These payment arrangements are individually negotiated prior to trading between the counterparties, and the rates and amounts may vary.<sup>17</sup> To reduce conflicts, retail brokers receive the same payment from all of their brokers. Payment is allocated between a combination of price improvement for customers and internal payments for services rendered. Even though certain retail brokers receive PFOF, the brokers and the wholesalers are still bound to best execution obligations. We note that not all retail brokers accept PFOF – for example, many traditional wealth management firms do not accept PFOF – although many if not most route orders.

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<sup>15</sup> In 2022, the DC Circuit upheld the SEC's Market Data Infrastructure Rule (MDIR), allowing them to move forward with implementation. The rule intends to increase the content of equity market data provided to investors and introduce competition into the dissemination of that data

<sup>16</sup> Off-exchange trades are still reported to the consolidated tape

<sup>17</sup> SEC Rule 606(a) requires broker-dealers to report certain aggregated order routing disclosures, including detailed disclosure of payments received from/paid to certain trading centers, and a discussion of relationships with those trading centers (payment or profit-sharing arrangements, etc.)



### Transaction-Based Expenses: Paid by Exchanges

- **Liquidity, routing, clearing, and other fees** – Exchanges may make various types of liquidity payments to equities trading customers to support market liquidity and trading volumes on the exchange (volume tiers offer a discount/premium to the applicable transaction fee). Additionally, some exchanges may incur routing charges, which occur when they do not have the best bid or offer in the market for a customer buy or sell order and must route the customer's order to the external market center that displays the best bid or offer. The external market center charges a fee per share (tenths of a cent per share) for executing the order.
- **Rebates** – Exchanges may offer a rebate on execution fees to firms who post orders on the exchange. Most exchanges pay a rebate to those adding liquidity and charge a fee to those removing liquidity (which would appear on the revenue side). Under a maker-taker pricing model – most exchanges operate this model – market participants who make the market (maker) generally receive a rebate, while market participants who trade against those markets (taker) pay a transaction fee.<sup>18</sup> These price incentives are rules of the exchange and must be filed with the SEC (all exchange fees are listed on their websites).

### Transaction-Based Expenses: Paid by Investors

- **Section 31 Fees** – Section 31 fees are assessed to recover the government's costs of supervising and regulating the securities markets and are subject to change. Section 31 fees make their way through the trading ecosystem. Exchanges are responsible for paying the fees to the SEC as a component of transaction and clearing fee revenue. They then collect corresponding activity assessment fees from member organizations clearing or settling trades on their exchanges. The activity assessment fees are designed to equal the Section 31 fees, resulting in a net zero transaction revenue number for the exchange.

However, this cash flow does not stop there. Section 31 fees can be included in the explicit costs to trade. These fees may therefore be passed through to investors – both institutional and retail – in their trade costs.

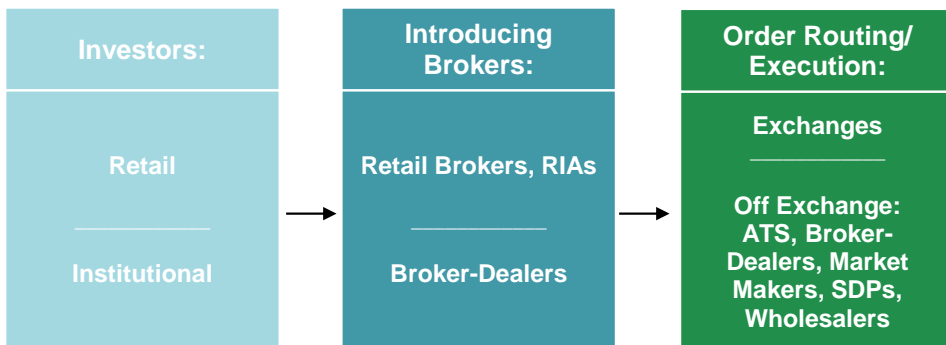
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<sup>18</sup> In maker/taker venues, limit orders are paid a rebate by the exchange while market orders pay the access fee to the exchange. For taker/maker venues, exchanges give a rebate to market orders and charge limit orders the access fee

**Mapping Cash Flows**

Many market participants believe that the current equity market structure provides investors choice – firms run different business models providing clients the services needed to meet their demands at their price point. However, the equity order routing process is complex, and all of its pieces, regulations, and best practices are intertwined. For example, PFOF has been attributed to enabling \$0 commissions for some retail investors. Market participants indicate that institutional investors have never had better opportunities to access liquidity. And, on the exchange side, Nasdaq's Chief Economist Phil Mackintosh's research showed that rebates (a) result in consistently cheaper spreads for investors and (b) can reduce costs of liquidity by as much or more than the cost of the rebates.

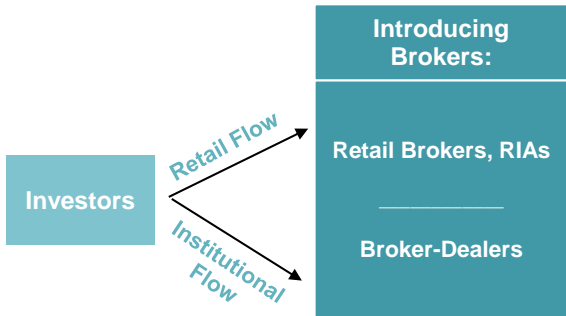
As discussed above, cash flows move across all ecosystems in commerce, and equity trading is no different. In this section, we created generic depictions of the different cash flows across the equity trading ecosystem, prior to reaching investors (who receive a zero or low commission trading environment). We begin by restating the categorization of market participants:



Note: ATS= alternative trading system; SDP = single-dealer platform. RIA = registered investment advisor. RIAs have the option to route through their clearing firm or manage their own connections and routing. Most prefer the former given cost constraints and the added regulatory and compliance burdens. That said, they are still responsible for best ex and any regulatory reporting/disclosures (ex: Rule 605).

**Mapping Cash Flows #1: Investors to Introducing Brokers**

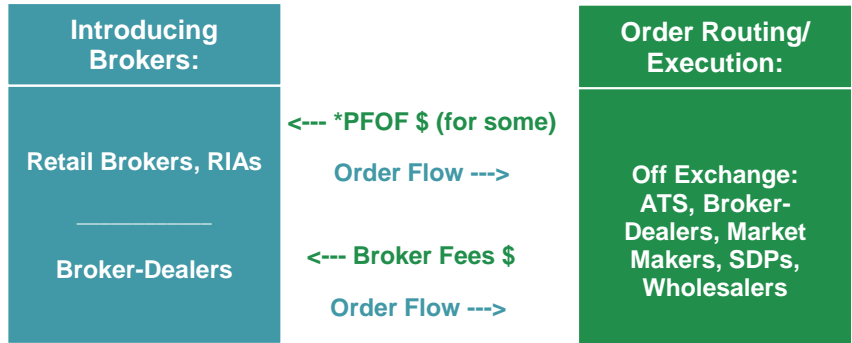
In the first stage, investors send their trades to introducing brokers – retail flow goes to retail brokers, institutional flow to broker-dealers.



Note: High-level depiction, not every order will go through every step. RIA = registered investment advisor. RIAs have the option to route through their clearing firm or manage their own connections and routing. Most prefer the former given cost constraints and the added regulatory and compliance burdens. That said, they are still responsible for best ex and any regulatory reporting/disclosures (ex: Rule 605).

**Mapping Cash Flows #2: Introducing Brokers to Off-Exchange Order Routing/Execution Firms**

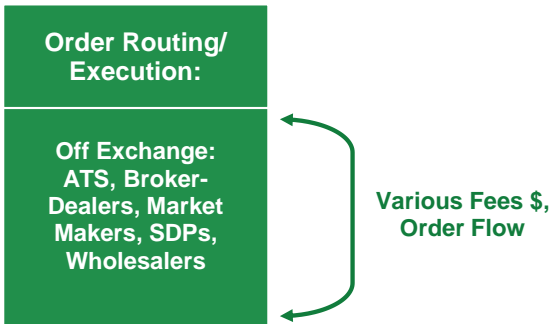
In the next stage, introducing brokers send their flow to off-exchange order routing/execution firms. Those firms in turn, (potentially\*) send payments to the introducing brokers.



Note: \*Not all firms accept PFOF – such as some traditional wealth management firms – yet many if not most route orders. High-level depiction, not every order will go through every step. RIA = registered investment advisor. RIAs have the option to route through their clearing firm or manage their own connections and routing. Most prefer the former given cost constraints and the added regulatory and compliance burdens. That said, they are still responsible for best ex and any regulatory reporting/disclosures (ex: Rule 605). Off-exchange trading was 41.9% of volumes in 2022; all trades are still reported to the consolidated tape. ATS = alternative trading system, SDP = Single-Dealer Platform

**Mapping Cash Flows #3A: Amongst Off-Exchange Order Routing/Execution Firms**

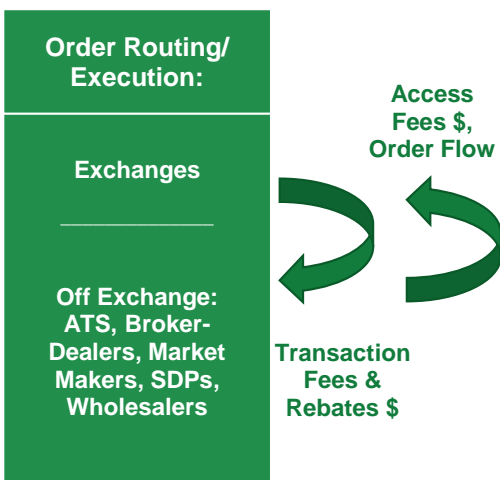
In the final stages, off-exchange order routing/execution firms swap various fees and order flow. For example, if one broker-dealer sends an order to another firm’s ATS, there could be an access fee for that venue.



Note: High-level depiction, not every order will go through every step. Off-exchange trading was 41.9% of volumes in 2022; all trades are still reported to the consolidated tape. ATS = alternative trading system, SDP = Single-Dealer Platform

**Mapping Cash Flows #3B: Exchanges and Off-Exchange Order Routing/Execution Firms**

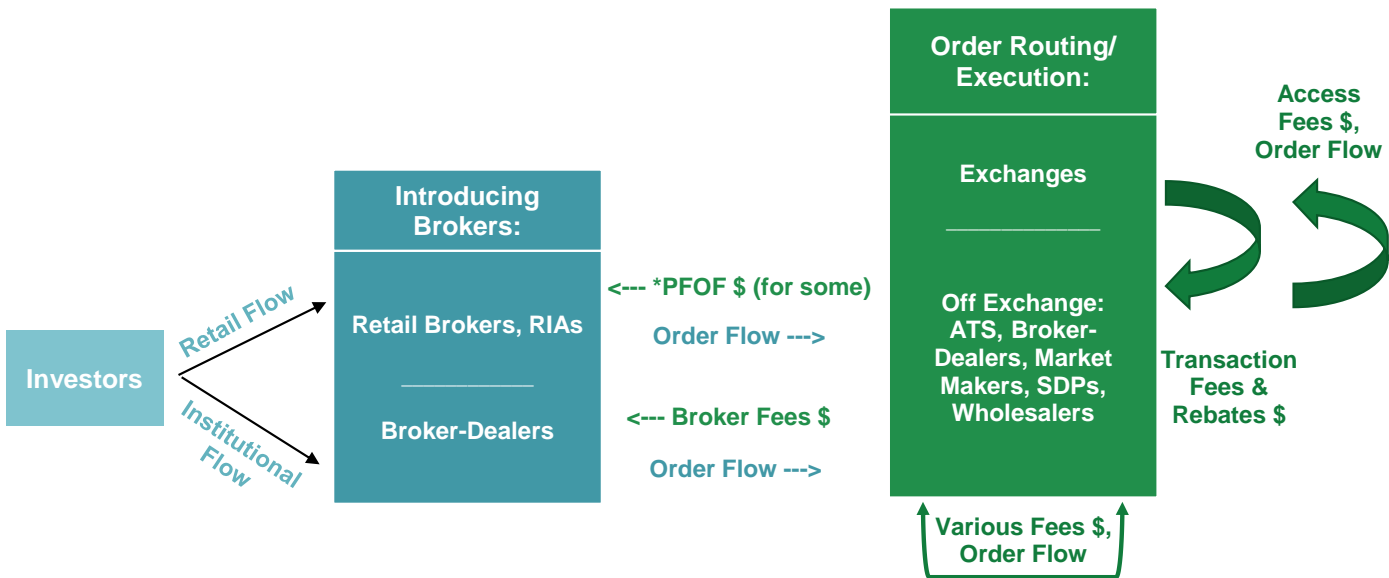
In the final stages, off-exchange order routing/execution firms send orders to the exchanges. Exchanges payout various fees – access fees, transaction fees, rebates – to attract this flow from the off-exchange order routing/execution firms. These firms will have to pay access fees to transact on the exchanges.



Note: High-level depiction, not every order will go through every step. Off-exchange trading was 41.9% of volumes in 2022; all trades are still reported to the consolidated tape. ATS = alternative trading system, SDP = Single-Dealer Platform

Mapping Cash Flows: Putting It All Together

Finally, we put together the diagram showing the different cash flows across the equity trading ecosystem.



Note: \* Not all firms accept PFOF – such as some traditional wealth management firms – yet many if not most route orders. High-level depiction, not every order will go through every step. RIA = registered investment advisor. RIAs have the option to route through their clearing firm or manage their own connections and routing. Most prefer the former given cost constraints and the added regulatory and compliance burdens. That said, they are still responsible for best ex and any regulatory reporting/disclosures (ex: Rule 605). Off-exchange trading was 41.9% of volumes in 2022; all trades are still reported to the consolidated tape. ATS = alternative trading system, SDP = Single-Dealer Platform

### Sizing Cash Flows

Next, we analyze the cashflows in the equity trading ecosystem, following the areas identified above in the definitions and mapping sections. We note that we use financial statement data from public companies as proxies for the industry. We look to financial statements for market maker Virtu Financial as the proxy for order routing/execution firms. On the exchange side, we look individually at the top three U.S. equity exchanges and their numbers in aggregate as the proxy for exchanges. As a reminder, each cost paid by the payer will have a corresponding revenue account for the payee. However, that revenue may not be retained in full, rather used to balance out cost line items or passed on as savings to customers, or a combination thereof.

Before looking at the financials, we review the concept of net revenue. When looking at the income statement of an exchange group, the revenue section breaks down net revenue as equal to gross revenue minus transaction-based expenses. For order routing/execution firms, transaction-based expenses are listed under the operating expense section of the income statement. The transaction-based expenses are the cost of revenue, as an exchange or order routing/execution firm must spend this money in order to generate trading revenue, i.e. attract liquidity to their platform/venue. As such, this is the metric used to analyze exchange and market maker revenues. Transaction-based expenses include:

- To an exchange – liquidity, routing, clearing, and other fees, plus rebates
- To an order routing/execution firm – brokerage, exchange, clearance fees and PFOF, plus interest and dividends expenses for the market making business

**Financial Statement Mapping: Order Routing/(Non Exchange) Execution Firms**

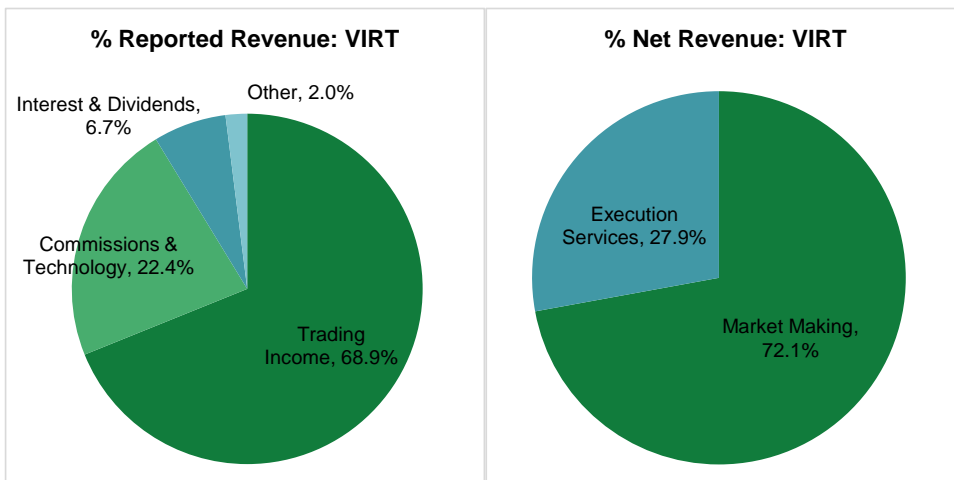
On the order routing/execution side of the trading ecosystem, we look to public financial statements for market maker Virtu Financial (VIRT) as the proxy for these firms. We note that not all firms will have the same business models or revenue breakout, and some order routing/execution businesses may be part of a larger financial institution, such as a global investment bank (please see the business model section above).

Order routing/execution firms such as VIRT hold two main operational functions, both of which are interrelated:

- **Market making** – Market makers provide liquidity to trading ecosystems, standing ready at all times to buy/sell securities. They earn profits by buying/selling large volumes of securities and earning small bid/ask spreads on each transaction.
- **Execution services** – Order routing/execution firms provide agency-based execution-only trading services, workflow technology and trading tools, and trading analytics to institutions, banks and broker-dealers.

VIRT earns the majority of its revenue by making markets. VIRT provides bids/offers in over 25,000 securities and other financial instruments on over 235 venues in 36 countries. It also provides agency execution services and trading venues in global equities, ETFs, fixed income, currencies, and commodities.

Looking at reported revenue, VIRT generates the majority of its reported revenue from trading income, 68.9%. On a net revenue basis – equal to reported revenue minus transaction-based expenses (please see the table on the next page) – its two business segments are market making and execution services, with market making earning 72.1% of net revenues.



Source: Company reports, SIFMA estimates (as of FY22)

Note: Other = interests in strategic investments and telecommunications joint ventures. VIRT's 10K indicates the majority of its market making revenue was derived from U.S. equities

Unlike exchanges, VIRT does not show the calculation of net revenue directly on its income statement. Its revenue section does not remove transaction-based expenses on the income statement itself, rather transaction-based expenses are listed under the operating expense section. However, VIRT does show the calculation for adjusted net trading income reconciliation in their supplemental earnings presentation, which analysts use for their financial models and earnings analyses. Transaction-based expenses include brokerage, exchange, clearance fees and PFOF, as well as interest and dividends expenses incurred in their market making business. The latter is the contra account to interest and dividends income, as reported in the Income Statement. Market makers must hold inventory of securities in which they make markets. As such, they collect and pay out all associated corporate actions, i.e. interest and dividend payments, involved with holding the securities. Adjusted net trading income uses the same formula for net revenue – reported revenue minus transaction-based expenses – but also excludes other income, which involves strategic partnerships (joint ventures, etc.).

For VIRT, transaction-based expenses represent 36.0% of reported revenues. In other words, the actual net revenue generated is only 64.0% of the reported total after paying out the transaction expenses mapped out in this section. Adjusted net trading income = Trading income, net + commissions, net and technology services minus transaction-based expenses. Adjusted net trading income was 62.1% of reported revenue.

<b>VIRT Net Revenue (\$M)</b>	
<b>Reported Revenues</b>	<b>2,364.8</b>
Trading income	1,628.9
Interest and dividends income	159.1
Commissions and technology services	529.8
Other	46.9
<b>Transaction-Based Expenses</b>	<b>850.2</b>
Brokerage, exchange, clearance fees and payments for order flow, net	619.2
Interest and dividends expense	231.1
<b>Net Revenue</b>	<b>1,514.6</b>
<b>Adjusted Net Trading Income</b>	<b>1,467.6</b>

Source: Company reports, SIFMA estimates (as of FY22)

Note: Adjusted Net Trading Income excludes other income (strategic investments). Brokerage, exchange, clearance fees and payments for order flow are net of rebates. VIRT incurs interest expense from loaning equities in the course of market making activities; dividend expense is incurred when a dividend is paid on securities sold short.

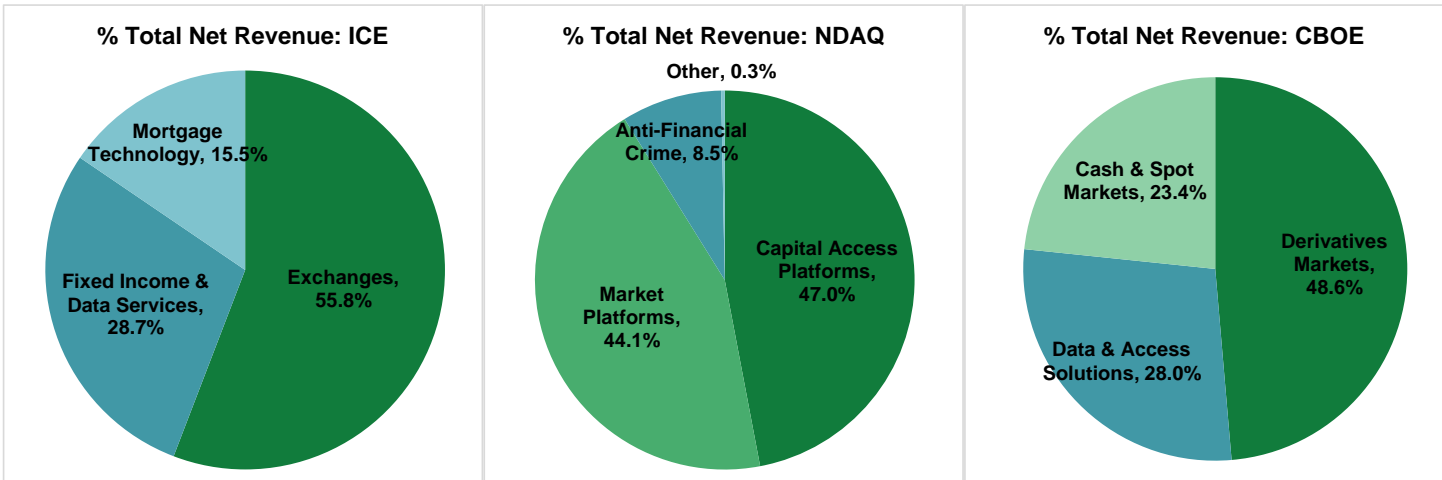


**Financial Statement Mapping: Exchanges**

Based on trading market share, Intercontinental Exchange (ICE, parent company of the New York Stock Exchange/NYSE), Nasdaq (NDAQ), and Cboe Global Markets (CBOE) are the top three exchanges in U.S. equities markets (51.0% of total 2022 trading volumes in aggregate). That said, all three exchange groups have different business models – some are more global, some are more diversified across asset classes, and they differ in size.

ICE is the largest firm, with \$7.3 billion in net revenue, followed by NDAQ at \$3.6 billion (0.5x ICE) and CBOE at \$1.7 billion (0.2x ICE). We note the following differences in business models:

- ICE has expanded extensively into fixed income and then mortgage products over the years
- NDAQ has a large technology segment and expanded into other areas (ex: anti-financial crime)
- CBOE remains the most tied to transaction and clearing revenues



Source: Company reports, SIFMA estimates (as of FY22)

Next, we look more closely at what the traditional global exchange businesses – and specifically the U.S. equity business – represent as a percentage of total net revenues. When breaking out net revenues across business units, CBOE is 100% exchange related, followed by NDAQ at 62.4% and then ICE at 55.8%. Within the exchange segment, CBOE has the largest exposure to U.S. cash equities at 21.8% (includes U.S. and Canada), followed by NDAQ at 11.1% and ICE at 5.2% (includes U.S. cash equities and options). (Please see table footnotes for business segment mapping.)

**Exchange Revenue Comparison**

(\$M)	ICE	NDAQ	CBOE	Top 3
<b>All Businesses</b>				
Gross Revenue	9,636	6,226	3,959	19,821
Less Transaction-Based Expenses	2,344	2,644	2,217	7,205
<b>Net Revenue</b>	<b>7,292</b>	<b>3,582</b>	<b>1,742</b>	<b>12,616</b>
<b>Global Exchange Businesses<sup>1</sup></b>				
Gross Revenue	6,415	4,878	3,959	15,252
Less Transaction-Based Expenses	2,344	2,644	2,217	7,205
<b>Net Revenue</b>	<b>4,071</b>	<b>2,234</b>	<b>1,742</b>	<b>8,047</b>
Exchanges as % Total Net Revenue	55.8%	62.4%	100.0%	63.8%
<b>US Equities Trading Businesses<sup>2</sup></b>				
Gross Revenue	2,722	2,041	1,682	6,445
Less Transaction-Based Expenses	2,344	1,644	1,303	5,291
<b>Net Revenue</b>	<b>378</b>	<b>397</b>	<b>379</b>	<b>1,154</b>
<b>US Equities as % Total Net Revenue</b>	<b>5.2%</b>	<b>11.1%</b>	<b>21.8%</b>	<b>9.1%</b>

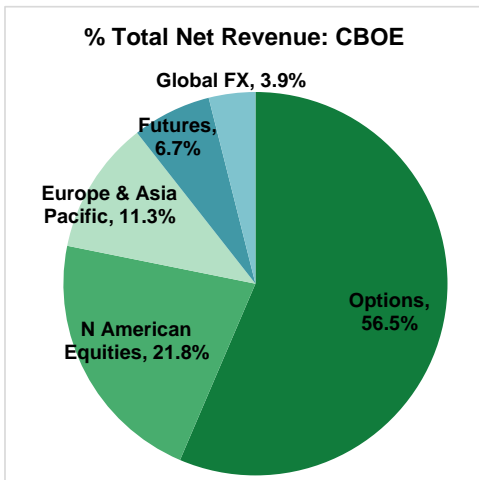
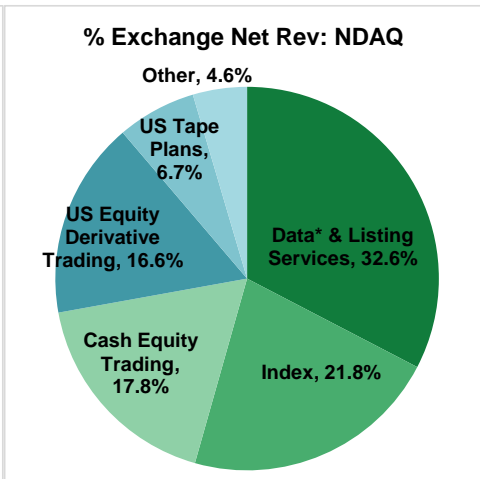
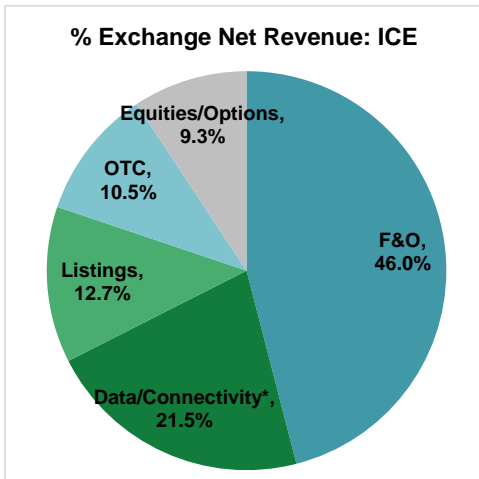
Source: Company reports, SIFMA estimates (as of FY22)

(1) Exchange Businesses: Includes all regions and asset classes, as well as trading and clearing revenue. ICE = as stated; NDAQ = Trading Services in Market Platforms + Data & Listing and Index in Capital Access Platforms; CBOE = as stated

(2) US Equities Trading Businesses: ICE = total NYSE businesses, cash equities and options; excludes data/connectivity/listings. NDAQ = as stated. ICE/NDAQ = trading only, no data/connectivity/listings; CBOE = as stated, but all North America (US + Canada)

The exchange groups also differ in composition of their exchange business segments:

- ICE’s largest segment remains futures & options trading and clearing – where it began its business – at 46.0% of total exchange net revenue, followed by global, multi asset class data/connectivity at 21.5%
- NDAQ’s largest segment is global, multi asset class data and listing at 32.6% of total exchange net revenue, followed by index at 21.8%
- CBOE’s largest segment is options trading at 56.5% of total exchange net revenue, followed by North American cash equities trading at 21.8%



Source: Company reports, SIFMA estimates (as of FY22)

Note: Data/Connectivity includes all regions and all asset classes. NDAQ data/connectivity sums market data and trade management services (connectivity). CBOE’s sixth business unit is Digital, which generated -0.4 million on a net basis

What all of the exchanges do have in common is that they have made concerted efforts over the years to become less reliant on transaction revenue. Transaction revenues are more volatile, causing fluctuations in earnings. Whereas non-transaction revenues are considered more stable, as they typically consist of recurring revenue streams. We highlight the following revenue breakouts in the total global exchange business segment – not just U.S. equities (not all firms breakout this detail for just U.S. equities) – across the exchanges:

- ICE has the highest percentage of revenue generated from transaction and clearing revenue at 65.8%
- This is followed closely by CBOE at 64.7%
- NDAQ has the lowest percentage at 45.6%

**Global Exchange Businesses: Transaction vs. Non Transaction Net Revenue**

(\$M)	ICE	NDAQ	CBOE	Top 3
<b>Transaction</b>	<b>2,679</b>	<b>1,019</b>	<b>1,127</b>	<b>4,825</b>
Transaction & clearing	2,679	1,019	1,127	4,825
<b>Non Transaction</b>	<b>1,392</b>	<b>1,215</b>	<b>614</b>	<b>3,221</b>
Listings*	515	729	0	1,244
Data and connectivity*	877	na	582	1,459
Market data*	na	na	276	276
Access fees*	na	na	306	306
Index	0	486	0	486
Other	0	0	33	33
<b>Total</b>	<b>4,071</b>	<b>2,234</b>	<b>1,742</b>	<b>8,047</b>
<b>% of Total</b>				
Transaction & clearing	65.8%	45.6%	64.7%	60.0%
Total Non Transaction	34.2%	54.4%	35.3%	40.0%
Listings*	12.7%	32.6%	na	15.5%
Data and connectivity*	21.5%	na	33.4%	18.1%
Market data*	na	na	15.8%	3.4%
Access fees*	na	na	17.6%	3.8%
Index	na	21.8%	na	6.0%
Other	na	0.0%	1.9%	0.4%

Source: Company reports, SIFMA estimates (as of FY22)

\*ICE and NDAQ include all regions and all asset classes; NDAQ groups data and listings together; CBOE lists its own stock and ETPs globally

Exchange Businesses Segments: ICE = as stated; NDAQ = Trading Services in Market Platforms + Data & Listings and Index in Capital Access Platforms; CBOE = as stated

ICE: Transaction = total transaction and clearing in Exchanges. Non transaction = data/connectivity services and listings in Exchanges

NDAQ: Transaction = net Trading Services in Market Platforms. Non transaction = Data & Listings and Index in Capital Access Platforms

CBOE: Transaction = Net Transaction and Clearing Fees. Non transaction = access and capacity and market data, plus non-transaction in Global FX. Other = trade reporting and Euro CCP net interest income in Europe and Asia Pac. Adjustments made to match to reported data

**U.S. Equity Trading Ecosystem Mapping: Access Fees + Market Data**

**Payer** (cost line item): order routing/execution firms + all market participants (for data)

**Payee** (revenue line item): exchanges

As discussed above, in the trading ecosystem there are costs associated with generating trading revenues, costs outside of the normal operating expenses to run a business. For example, broker-dealers and wholesalers may elect to pay access fees to connect to all sixteen exchanges in order to support their execution business. Market participants must purchase market data to verify they are meeting best execution regulatory obligations.

Looking at VIRT's income statement, brokerage, exchange, clearance fees and PFOF represent the largest operating expense, 34.2% of total operating expenses. In general across industries, total labor costs are typically the largest expense line item for companies, accounting for as much as 70% for some industries. However, for VIRT, its largest line item, brokerage, exchange, clearance fees and PFOF, comes in at 1.6x employee compensation and payroll taxes. Adding in the interest and dividends expense line item, total transaction-based expenses represent 47.0% of total operating expenses and are 2.2x employee-based expenses.

VIRT Operating Expenses	\$M	% Total	Trans/ Other Exp*
<b>Brokerage, exchange, clearance fees and payments for order flow (Trans)</b>	<b>619.2</b>	<b>34.2%</b>	
Employee compensation and payroll taxes	390.9	21.6%	1.6x
Communication and data processing	219.5	12.1%	2.8x
<b>Interest and dividends expense</b>	<b>231.1</b>	<b>12.8%</b>	2.7x
Operations and administrative	86.1	4.8%	7.2x
Financing interest expense on long-term borrowings	92.0	5.1%	6.7x
Amortization of purchased intangibles and acquired capitalized software	64.8	3.6%	9.5x
Depreciation and amortization	66.4	3.7%	9.3x
Termination of office leases	7.0	0.4%	88.7x
Debt issue cost related to debt refinancing, prepayment and commitment fees	29.9	1.7%	20.7x
Transaction advisory fees and expenses	1.1	0.1%	550.9x
<b>Total Operating Expenses</b>	<b>1,808.0</b>		
<b>Transaction-Based Expenses</b>	<b>850.2</b>	<b>47.0%</b>	

Source: Company reports, SIFMA estimates (as of FY22)

Note: Trans/Other Exp = brokerage, exchange, clearance fees and PFOF (Trans) / each other expense item, to show the ratio that Trans represents to other expenses

**Securities Information Processor (SIP) Data**

With 16 exchanges, over 30 alternative trading system (ATS), and over 200 over-the-counter venues, the U.S. equity markets are highly fragmented. The objective of the SIP is to bring this fragmentation back together by centralizing trade reporting from all market participants, by mandating the consolidation of best prices, or the NBBO<sup>19</sup>, across all trading venues.<sup>20</sup> This consolidated information is then sold to users, paying both monthly fixed and variable costs.

The SIP revenue pool averaged \$414.4 million per annum over the last five years, a 1.9% 5-year CAGR. Revenue has increased since the COVID era – the three year average prior to COVID was \$388.5 million, -6.3% to the full five-year average – with the majority of the increase coming in the TRF<sup>21</sup> revenue segment, which has increased with the growth in retail investing. That said, TRF revenue was only 17.1% on average of total SIP revenue, or \$70.8 million (3.7% 5-year CAGR), with exchanges collecting the other 82.9% of revenues generated (\$343.6 million, 1.6% 5-year CAGR). 2022 revenues remain elevated to pre-COVID level at \$428.4 million, +10.3% to the three year pre-COVID average. On the following pages, we highlight trends across total revenue, TRF, and exchanges.

(\$)	2018	2019	2020	2021	2022	Average
<b>Total SIP Revenue</b>						
Total Tape A	163,769,187	162,910,535	175,168,125	178,802,153	170,419,107	170,213,821
Total Tape B	93,721,172	95,801,143	102,066,098	108,919,653	107,805,935	101,662,800
Total Tape C	131,877,870	130,679,783	145,791,054	154,050,688	150,205,512	142,520,981
<b>Total</b>	<b>389,368,229</b>	<b>389,391,461</b>	<b>423,025,277</b>	<b>441,772,494</b>	<b>428,430,554</b>	<b>414,397,603</b>
Y/Y change		0.01%	8.6%	4.4%	-3.0%	1.9%
<b>SIP TRF Revenue</b>						
Total Tape A	22,809,014	23,789,463	26,749,008	27,747,034	26,150,234	25,448,951
Total Tape B	18,409,464	19,575,124	20,739,150	22,321,104	21,763,793	20,561,727
Total Tape C	21,304,373	21,492,473	25,863,315	28,132,109	26,942,043	24,746,863
<b>Total</b>	<b>62,522,851</b>	<b>64,857,060</b>	<b>73,351,473</b>	<b>78,200,247</b>	<b>74,856,070</b>	<b>70,757,540</b>
Y/Y change		3.7%	13.1%	6.6%	-4.3%	3.7%
% of Total	16.1%	16.7%	17.3%	17.7%	17.5%	17.1%
<b>SIP Exchange Revenue</b>						
Total Tape A	140,960,173	139,121,072	148,419,117	151,055,119	144,268,873	144,764,871
Total Tape B	75,311,708	76,226,019	81,326,948	86,598,549	86,042,142	81,101,073
Total Tape C	110,573,497	109,187,310	119,927,739	125,918,579	123,263,469	117,774,119
<b>Total</b>	<b>326,845,378</b>	<b>324,534,401</b>	<b>349,673,804</b>	<b>363,572,247</b>	<b>353,574,484</b>	<b>343,640,063</b>
Y/Y change		-0.7%	7.7%	4.0%	-2.7%	1.6%
% of Total	83.9%	83.3%	82.7%	82.3%	82.5%	82.9%

Source: Consolidated Tape Association, UTP Plan Administration, SIFMA estimates

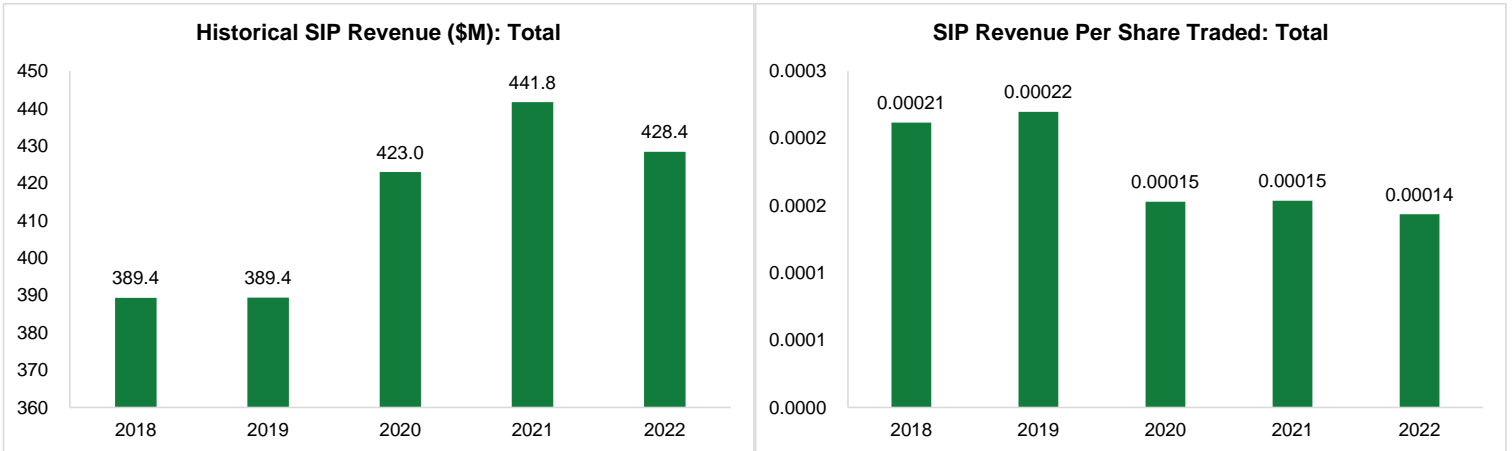
Note: Tape A = NYSE listed stocks; Tape C = Nasdaq listed stocks; Tape B = regionals, mostly traded on NYSE Arca (or NYSE American). In average, the growth rate is a 5-year CAGR

<sup>19</sup> National Best Bid and Offer = the highest bid and lowest ask price for a stock, sourced from all available exchanges or trading venues

<sup>20</sup> SIP collects data required to meet trading rules (Rule 603), identifying the NBBO and sharing it with the market. NBBO prices are protected (Rule 611), thereby limited to locked & crossed markets (Rule 610). NBBO measures execution performance of covered orders (Rule 605) & ensures off-exchange trades do not happen at prices worse than exchange prices. All other data – large order imbalances requiring additional liquidity, non-marketable quotes/cancellations, etc. – is optional & purchased by a limited set of subscribers. The SIP is, as such, considered limited in its usefulness.

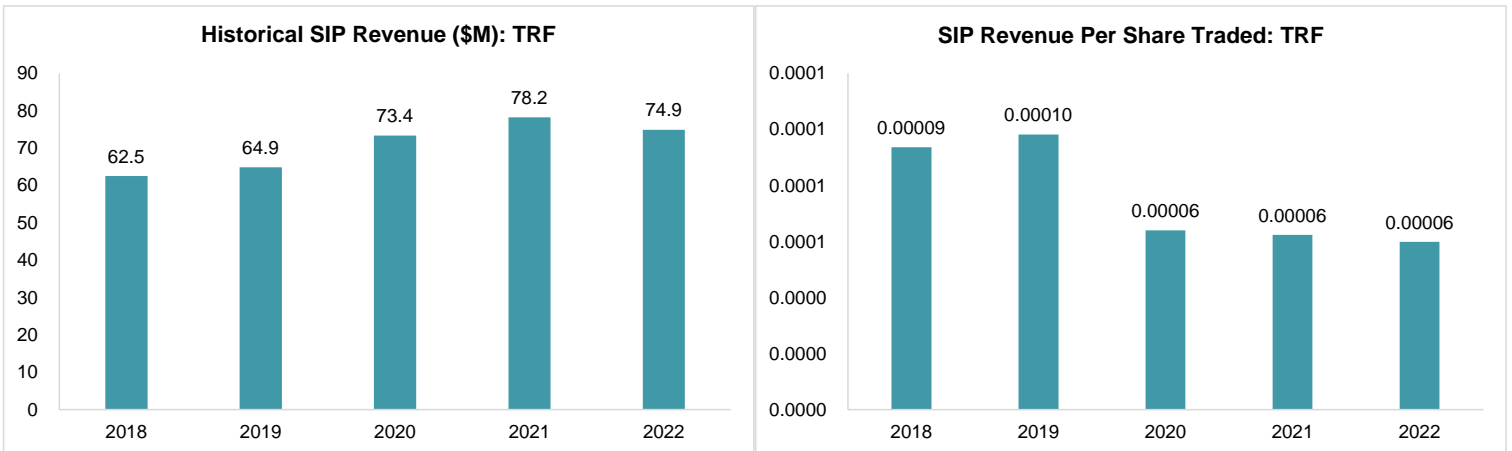
<sup>21</sup> FINRA Trade Reporting Facility = a mechanism for the reporting of transactions effected otherwise than on an exchange

- Total SIP revenue averaged \$414.4 million from 2018-2022
  - 2022 was \$428.4 million, -3.0% Y/Y
  - 2022 was \$0.00014 per share on average (based on total aggregate volume for the year), -6.5% Y/Y



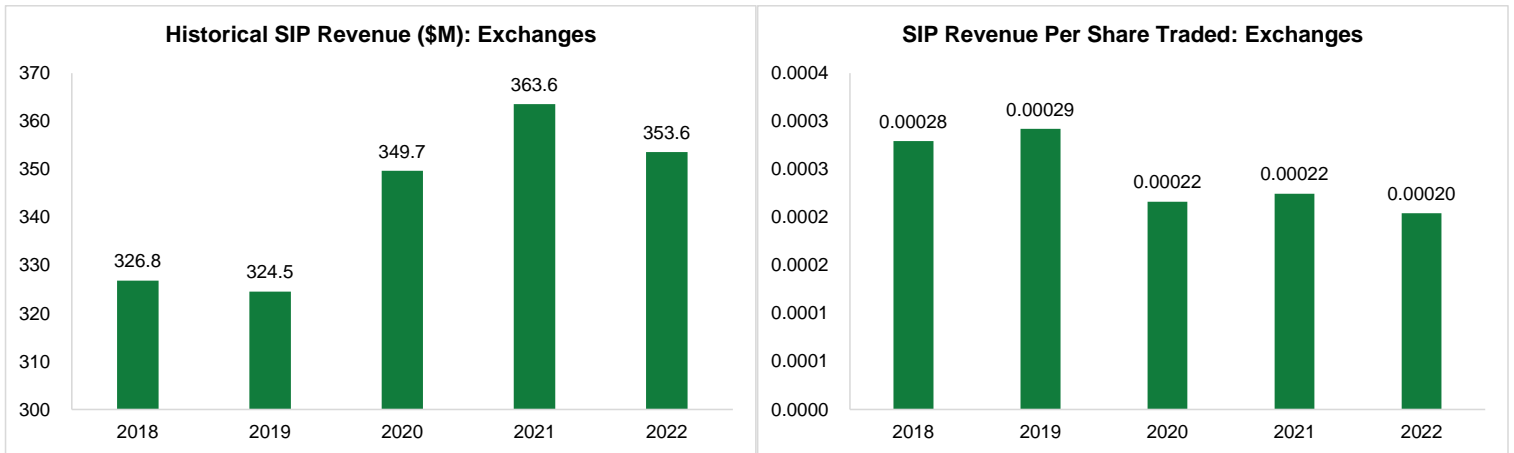
Source: Consolidated Tape Association, UTP Plan Administration, SIFMA estimates

- TRF revenue averaged \$70.8 million from 2018-2022
  - 2022 was \$74.9 million, -4.3% Y/Y
  - 2022 was \$0.00006 per share on average (based on total aggregate volume for the year), -4.0% Y/Y



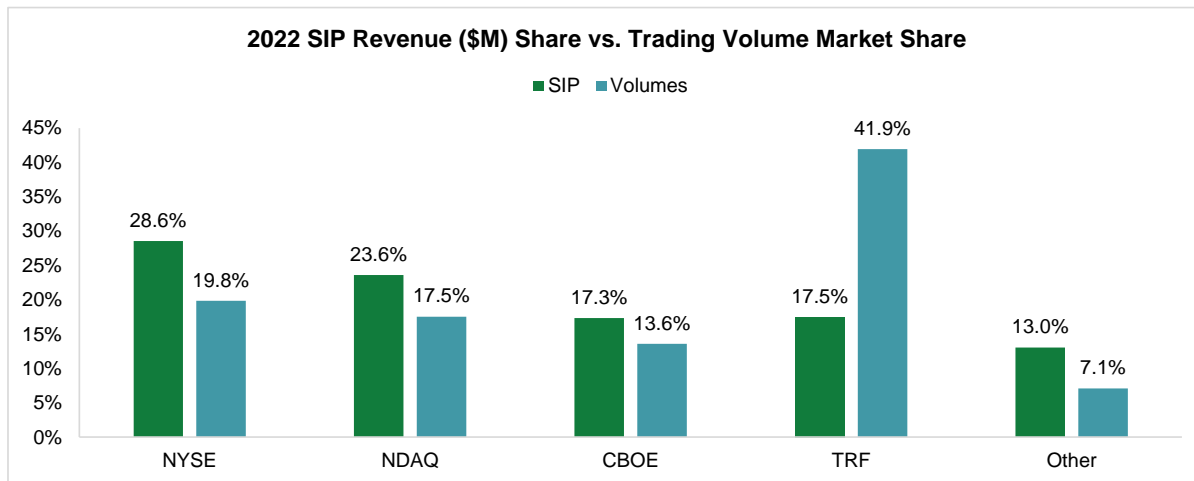
Source: Consolidated Tape Association, UTP Plan Administration, SIFMA estimates

- Exchange revenue averaged \$343.6 million from 2018-2022
  - 2022 was \$353.6 million, -2.7% Y/Y
  - 2022 was \$0.00020 per share on average (based on total aggregate volume for the year), -9.0% Y/Y



Source: Consolidated Tape Association, UTP Plan Administration, SIFMA estimates

While Reg NMS created a complex formula that includes quotes and prints, from a data perspective the breakout of SIP revenue falls in line with trading market share. Looking at the breakout of SIP revenue collected for 2022, NYSE was on top at 28.6%, in line with its leading 19.8% trading volume market share. On average, the percent of SIP revenue collected was around 6.1 pps greater than that exchange groups trading volume market share. TRF revenue was, however, around 25% less than its trading market share, as the TRFs do not earn quoting revenue (exchanges earn quoting plus trading revenue). This is attributed to the makeup of this segment, with these trades paying lower SIP fees.



Source: Consolidated Tape Association, UTP Plan Administration, SIFMA estimates

Note: Other includes IEX, LTSE, MEMX, and MIAAX.



**U.S. Equity Trading Ecosystem Mapping: PFOF**

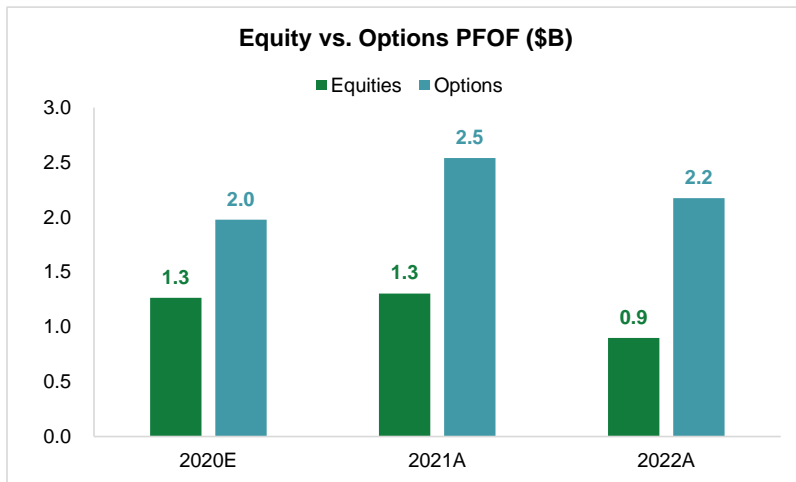
**Payer** (cost line item): order routing/execution firms

**Payee** (revenue line item): retail brokers<sup>22</sup>

PFOF may be paid by wholesalers to some retail brokers – not all retail brokers accept PFOF (ex: some traditional wealth management firms; yet many if not most route orders) – for the right to trade with its customer order flow. In an attempt to size out the level of PFOF versus other market factors, we compare it across asset classes and to other equity trading metrics.

**#1:** PFOF is smaller in equities versus the multi-listed options market:

- Equities – PFOF averaged \$1.2 billion over the last three years
- Options – PFOF averaged \$2.2 billion over the last three years
- On average, PFOF in equities is 0.5x the level in options, ranging from 0.4x to 0.6x across the years

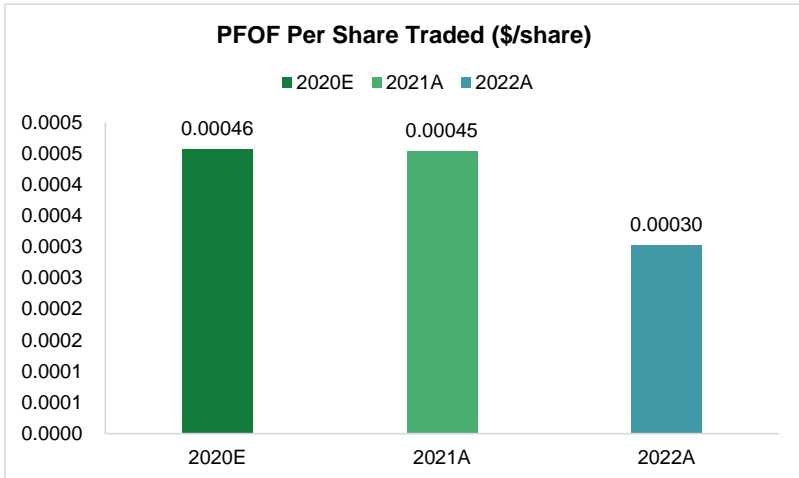


Source: SEC Rule 606 filings as compiled by Bloomberg Intelligence

Note: Due to data limitations and timing, actual 2020 figures are extrapolated to full year results to make an annual comparison; 2020 original data from July to December

<sup>22</sup> While listed as a revenue for simplicity sake – revenue as the contra to the cost account – retail brokers allocate these funds across a balance of price improvement for customers and internal payments for services provided to clients

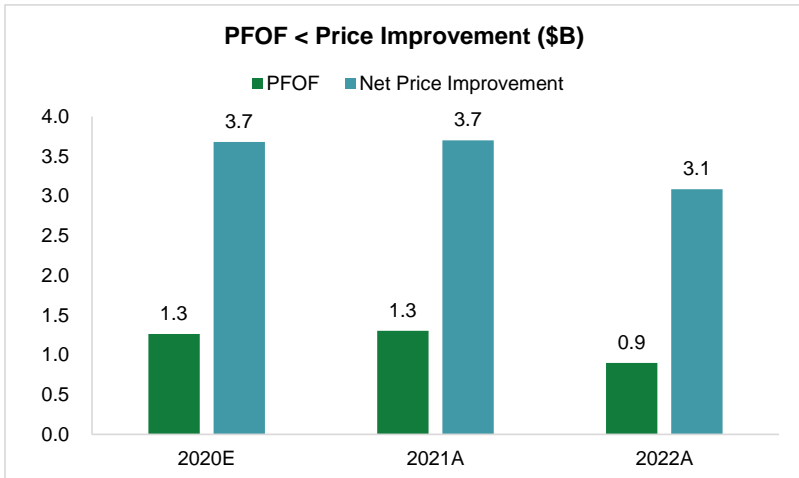
#2: While PFOF will vary year to year with volumes and volatility levels, we note that it is small in relation to total trading volumes (total shares traded in the selected time period). PFOF ranged from \$0.00030 per share to \$0.00046 per share across the years, or averaged \$0.00040 per share in equities:



Source: SEC Rule 606 filings as compiled by Bloomberg Intelligence  
 Note: Due to data limitations & timing, actual 2020 figures are extrapolated to full year results to make an annual comparison; 2020 from July-December

#3: PFOF is also much smaller than the levels of net price improvement retail clients receive:

- PFOF – averaged \$1.2 billion over the last three years
- Net price improvement – averaged \$3.5 billion over the last three years
- PFOF/Net price improvement
  - Average 0.3x – price improvement received by investors was much larger than payments made
  - Range 0.3x to 0.4x



Source: SEC Rule 606 filings as compiled by Bloomberg Intelligence  
 Note: Due to data limitations & timing, PFOF 2020 figures are extrapolated to full year results to make an annual comparison; 2020 from July-December

**U.S. Equity Trading Ecosystem Mapping: Liquidity, Routing, Clearing & Other Fees + Exchange Rebates**

**Payer** (cost line item): exchanges

**Payee** (revenue line item): order routing/execution firms

For exchanges, transaction expenses are the cost of revenue: liquidity payments, routing, clearing, and other fees, plus. Exchanges spend this money in order to generate trading and clearing revenue. Looking at the financial statements for the top three U.S. equity exchanges, we note that on average the total cost of revenues represents 35.1% of the total global exchange business segments and 82.1% of the U.S. equities business. We highlight the following:

- ICE: 36.5% of total global exchange business (which represents 55.8% of total net revenues), 86.1% of U.S. equities net revenue (which represents 5.2% of total net revenues)
- NDAQ: 54.2% of total global exchange business (which represents 62.4% of total net revenues), 80.5% of U.S. equities net revenue (which represents 11.1% of total net revenues)
- CBOE: 56.0% of total global exchange business (which represents 100.0% of total net revenues), 77.5% of U.S. equities net revenue (which represents 21.8% of total net revenues)

**Global Exchange Businesses: Cost of Revenues**

Transaction-Based Expenses	ICE	NDAQ	CBOE	Top 3
<b>Cost of Revenues (\$M)</b>				
Liquidity payments, routing, clearing, and rebates	1,845	2,119	1,753	3,872
Liquidity payments, rebates		2,092	1,670	3,762
Routing & clearing; brokerage, clearance & exchange fees		27	83	110
Section 31 fees*	499	525	330	1,354
Other			134	134
<b>Total Cost of Revenues</b>	<b>2,344</b>	<b>2,644</b>	<b>2,217</b>	<b>5,360</b>
Attributed to US equities	2,344	1,644	1,303	5,291
<b>% of Gross Total Exchange Revenue</b>				
Liquidity payments, routing, clearing, and rebates	28.8%	43.4%	44.3%	25.4%
Liquidity payments, rebates		42.9%	42.2%	24.7%
Routing & clearing; brokerage, clearance & exchange fees		0.6%	2.1%	0.7%
Section 31 fees*	7.8%	10.8%	8.3%	8.9%
Other			3.4%	0.9%
<b>Total Cost of Revenues</b>	<b>36.5%</b>	<b>54.2%</b>	<b>56.0%</b>	<b>35.1%</b>
Attributed to US equities	86.1%	80.5%	77.5%	82.1%

Source: Company reports, SIFMA estimates (as of FY22)

Exchange Businesses: Includes all regions and asset classes, as well as trading and clearing revenue. ICE = as stated; NDAQ = Trading Services in Market Platforms + Data & Listing and Index in Capital Access Platforms; CBOE = as stated  
 US Equities Trading Businesses: ICE = total NYSE businesses, cash equities and options; excludes data/connectivity/listings. NDAQ = as stated; CBOE = as stated, but all North America (US + Canada)

\*Section 31 fees are pass through expenses; included in both the revenue and expense line items, they have a net zero impact on actual revenues. ICE does not separate fees attributed to equities versus options.

**U.S. Equity Trading Ecosystem Mapping: Section 31 Fees**

**Payer** (cost line item): investors<sup>23</sup>, both retail and institutional

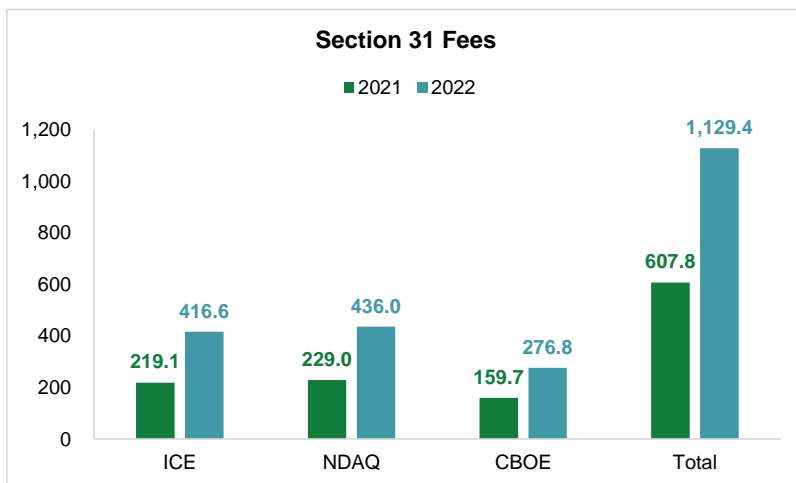
**Payee** (revenue line item): SEC

Finally, we note the existence of another fee in the trading ecosystem, one which may be passed through to investors, both retail and institutional. Section 31 fees are assessed to recover the SEC’s costs of supervising and regulating the securities markets and are subject to change (the agency will publish the schedule and revisions each year). These fees will vary year to year with volume and volatility levels, capped at the SEC’s target based on its budget needs.

While exchanges are tasked with collecting this fee for the SEC, the money is recouped by charging back these costs to exchange members trading on their exchange. These firms, in turn, may pass the costs down to their clients. In the end, this fee may be included in the total cost of the trade (an explicit cost to trade). Therefore, the fee may ultimately be paid by the investor.

We highlight the following for Section 31 fees:

- Cumulative total \$1.1 billion<sup>24</sup>, +85.8% Y/Y – the increase was predominately driven by an increase in the fee, to \$16.30 per million dollars of covered sales from \$7.80 (+109.0%), versus an aggregate volume increase of +3.7% Y/Y
- Averaged \$376.5 million per exchange in 2022
- Range \$276.8-\$436.0 million across exchanges in 2022



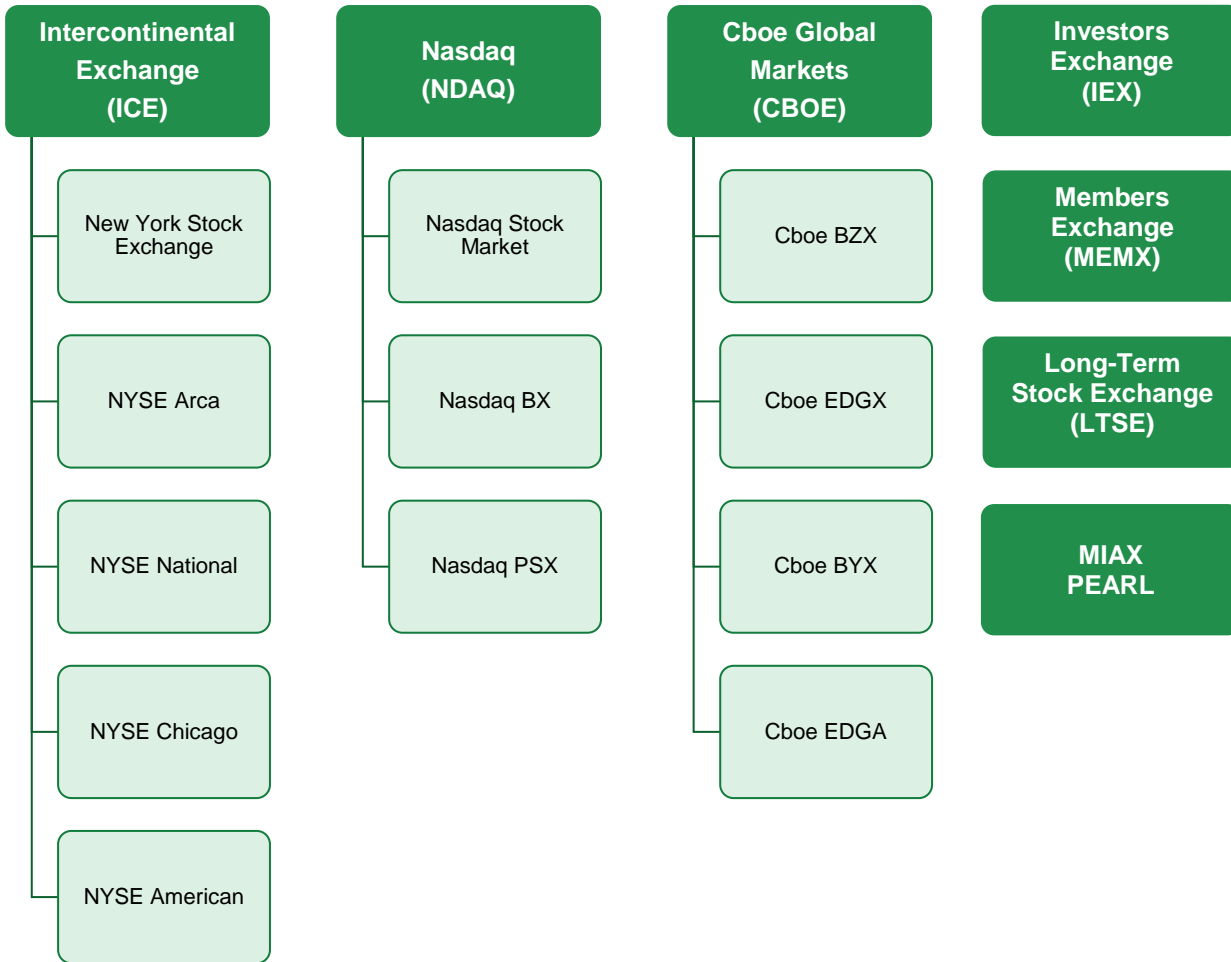
Source: Company reports, SIFMA estimates

Note: ICE reports total S31 fees; to get equities we applied the percent of total equities represented on average for the other exchanges

<sup>23</sup> Section 31 fees could be shouldered by broker-dealers instead of passing along to investors

<sup>24</sup> ICE (NYSE) only lists aggregate Section 31 fees for cash equities and multi-listed options; an equity total was estimated by applying the average percentage (equities as a percent of total S31 fees) of the other two exchanges to ICE’s total number

## Appendix: Equity Exchange Landscape



## Appendix: SIFMA Insights Research Reports

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SIFMA Insights: [www.sifma.org/insights](http://www.sifma.org/insights)

- Ad hoc reports on timely market themes
- Market Structure Compendium (annual report)
- COVID Related Market Turmoil Recaps: Equities; Fixed Income and Structured Products

Monthly Market Metrics and Trends: [www.sifma.org/insights-market-metrics-and-trends](http://www.sifma.org/insights-market-metrics-and-trends)

- Statistics on volatility and equity and listed options volumes
- Highlights an interesting market trend

Market Structure Primers: [www.sifma.org/primers](http://www.sifma.org/primers)

- Capital Markets Primer Part I: Global Markets & Financial Institutions
- Capital Markets Primer Part II: Primary, Secondary & Post-Trade Markets
- Global Equity Markets
- Electronic Trading
- US Capital Formation & Listings Exchanges
- US Equity
- US Multi-Listed Options
- US ETF
- US Fixed Income
- SOFR: The Transition from LIBOR
- The Evolution of the Fintech Narrative

Conference Debriefs

- Insights from market participants into top-of-mind topics
- Pre-Conference Survey Comparison, compares survey results across various conferences

Equity Market Structure Analysis

- Analyzing the Meaning Behind the Level of Off-Exchange Trading, Part II
- Analyzing the Meaning Behind the Level of Off-Exchange Trading
- Why Market Structure and Liquidity Matter

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