

## A Window on Index Liquidity: Volumes Linked to S&P DJI Indices

### Contributors

**Chris Bennett, CFA**  
 Director  
 Index Investment Strategy  
[chris.bennett@spglobal.com](mailto:chris.bennett@spglobal.com)

**Tim Edwards, PhD**  
 Managing Director  
 Index Investment Strategy  
[tim.edwards@spglobal.com](mailto:tim.edwards@spglobal.com)

**Sherifa Issifu**  
 Analyst  
 Index Investment Strategy  
[sherifa.issifu@spglobal.com](mailto:sherifa.issifu@spglobal.com)

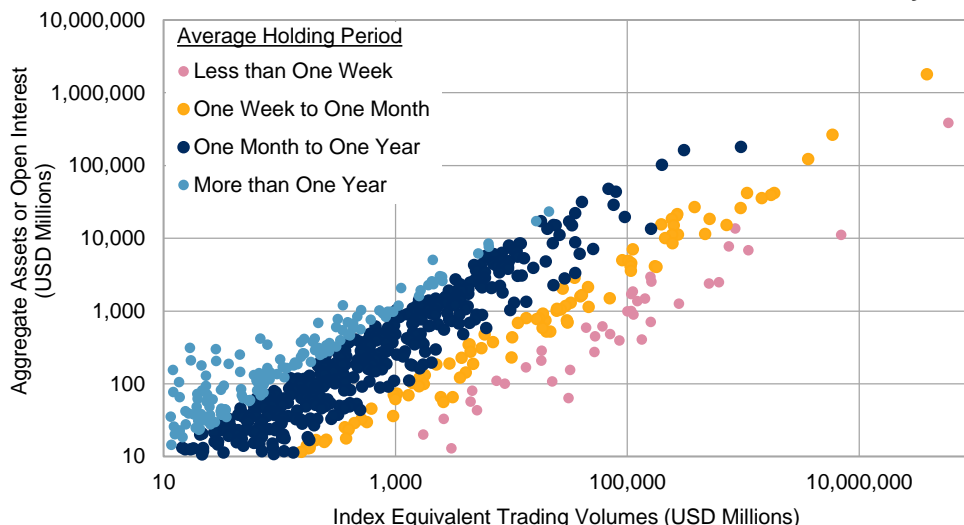
**Craig J. Lazzara, CFA**  
 Managing Director  
 Index Investment Strategy  
[craig.lazzara@spglobal.com](mailto:craig.lazzara@spglobal.com)

### EXECUTIVE SUMMARY

A robust and active trading ecosystem benefits asset owners and investment managers by fostering transparency, market efficiency, and investor confidence. This paper documents, for the first time, the extent and nature of that ecosystem for indices produced by S&P Dow Jones Indices (S&P DJI). The results offer a window into trading around certain market benchmarks, providing a new perspective on the use of indices as the basis for active and passive investment strategies.

- We measure aggregate U.S. dollar total volumes for a range of benchmarks including the [S&P 500®](#) and the [Dow Jones Industrial Average®](#).
- We suggest the potential **network effects in liquidity** that can develop between products tracking related indices.
- We demonstrate that average holding periods can vary widely across index vehicles (see Exhibit 1), illustrating the **high level of active usage of some passive investment products**.

**Exhibit 1: Some Passive Investment Vehicles Have Traded Quite Actively**



Source: S&P Dow Jones Indices LLC. Average holding period is computed by (assets/IET) x 365. Data as of June 30, 2019. See Exhibit 6 for further details. Chart is provided for illustrative purposes.

## THE IMPORTANCE OF VOLUMES IN INDEX-LINKED PRODUCTS

*While flows into passive investment vehicles are regularly reported in the media...*

The growth in aggregate assets under management in “passive” or index-tracking funds and portfolios has been the subject of considerable professional and media commentary.<sup>1</sup> However, while index providers and other organizations regularly produce reports estimating the value of assets tracking (or benchmarked to) indices,<sup>2</sup> comprehensive estimates of secondary market *volumes* in passive vehicles are harder to find.

*...the lack of trading data may lead to an overestimate of the proportion that is truly passively invested.*

This is unfortunate, because **volumes can tell us how active the users of passive investment vehicles truly are.** Passive funds can, and often do, have active owners who trade in and out of their positions frequently. **Volume data can also give us an indication of how well a market is “policed” by arbitrageurs,** whose identification and exploitation of mispricings has the potential to operate at the level of entire markets as well as individual constituents.

**Volumes are also important to passive investors, even if they have relatively simple objectives.** Consider that an investor can buy an ETF linked to the S&P 500, hold it for 20 years, and expect to earn a return comparable to the performance of an index that is reported in the evening news. Such confidence depends on two factors:

- At the time he transacts, whether buying or selling, the investor relies on the work of a small army of arbitrageurs who monitor the relationship between the price of the ETF and the weighted average price of the 500 index components.<sup>3</sup>
- Even when not transacting, the investor can benefit from the continued visibility of the S&P 500. This prominence not only attracts the arbitrageurs who facilitate efficient pricing, but also invites the scrutiny of other market participants and commentators, whose engagement provides transparency and helps ensure that the index continues to accomplish its stated purpose.

*If active engagement is persistently high, investors can feel more confident that they can buy an ETF linked to the S&P 500, hold it for 20 years, and get a price that reflects the index return when they finally sell it.*

**Market efficiency is not the gift of a benevolent Providence;** it is possible only when there is a trading ecosystem sufficiently large and active to minimize mispricings.

<sup>1</sup> Not all of it friendly. See, e.g., Ganti, Anu R. and Craig J. Lazzara, [“The Slings and Arrows of Passive Fortune,”](#) S&P Dow Jones Indices, 2018.

<sup>2</sup> S&P DJI regularly issues estimates of the total value of assets tracking its indices. The most recent figures (at time of publication) are provided in the [“Annual Survey of Assets”](#) as of Dec. 31, 2018.

<sup>3</sup> If the ETF is too cheap (i.e., doesn’t reflect the full value of its constituents), they buy the ETF and short the components (or another product that tracks the same index); if the ETF is too expensive, they do the opposite.

## INDEX EQUIVALENT TRADING VOLUMES IN S&P DJI INDICES

*Index equivalent trading volume (IET) reflects the economic exposure to the index that is being transacted at the time a trade occurs.*

In order to provide an aggregate statistic for *all* the relevant trading in products linked to each index, we must specify how trading in different types of products—including options—should be treated.

We introduce the notion of **index equivalent trading volume (IET)** in order to distinguish our calculation from alternatives often used to report trading activity. The IET reflects the economic exposure to the index that is being transacted at the time a trade occurs; it is determined by the instrument's short-term responsiveness to movements in the underlying index.<sup>4</sup>

Exhibit 2 provides a breakdown of IET associated with selected S&P DJI indices. The data encompass a 12-month period of trading in more than 1,300 products tracking over 500 indices and listed in 28 different countries.

**Exhibit 2: Index Equivalent Trading Volume of S&P DJI Indices (USD Billions)**

INDEX CATEGORY	TOTAL	FUTURES	OPTIONS	ETPS
<b>U.S. BROAD EQUITY</b>				
S&P 500	127,560	61,525	58,613	7,422
Dow Jones Industrial Average	7,773	7,167	155	451
S&P MidCap 400®	1,040	865	4	171
<b>INTERNATIONAL EQUITY</b>				
S&P/ASX 200	1,949	1,744	201	4
S&P/TSX 60	1,181	1,106	8	67
<b>EQUITY SECTORS</b>				
S&P 500 Sectors	2,735	242	185	2,308
Other Equity Sector	1,437	22	174	1,241
<b>OTHER</b>				
VIX® and Equity Derivatives	1,848	1,120	157	571
All Other S&P DJI Index-Linked Products	1,399	100	111	1,188

Source: S&P Dow Jones Indices LLC, FIA, Bloomberg. Data as of June 30, 2019. Each product was placed into one of three product categories: futures, options, and ETPs, the latter of which includes "vanilla" ETFs and less common structures such as leveraged and inverse ETFs, and exchange-traded notes (ETNs). Note that the options column includes both options linked to indices and options on index-linked ETPs. Further details are provided in the Appendix. Table is provided for illustrative purposes.

The magnitude of the figures in Exhibit 2 shows that index-linked products attracted market participants who traded frequently enough to register cumulative annual volumes reaching into the trillions of U.S. dollars.

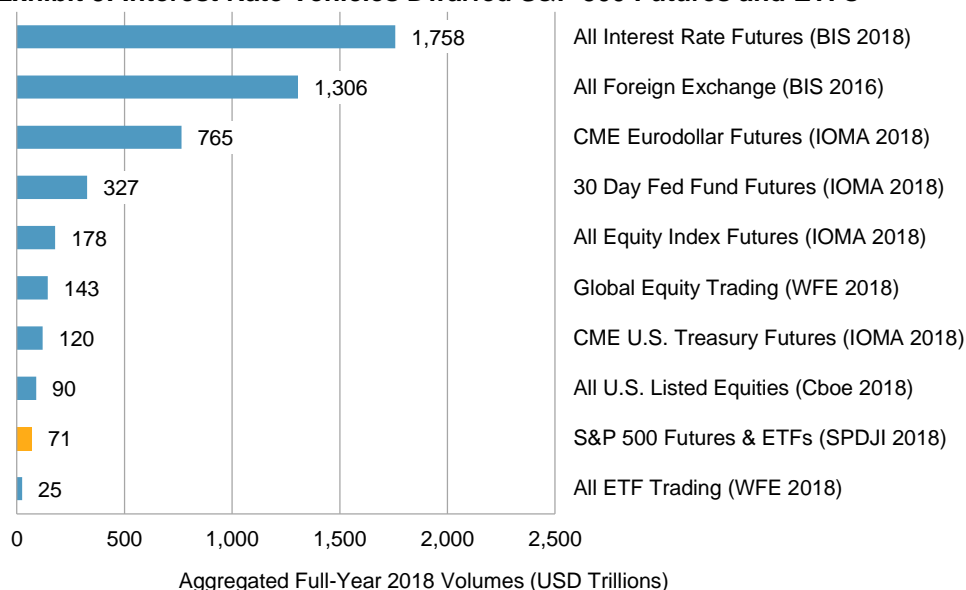
*Exhibit 2 highlights a range of S&P DJI indices that were associated with index equivalent trading volumes above USD 1 trillion.*

<sup>4</sup> Details of how the IET is calculated for various product types are provided in the Appendix.

Exhibit 3 compares the index equivalent trading associated with the S&P 500 to trading volumes in other selected instruments and categories during calendar 2018.<sup>5</sup> In order to provide a more “apples to apples” comparison, we only included futures contracts and unleveraged ETFs linked to the S&P 500.

*Exhibit 3 provides a comparison between volumes in futures and ETFs linked to the S&P 500 to volumes for a range of products and categories reported for 2018 in other publications.*

**Exhibit 3: Interest Rate Vehicles Dwarfed S&P 500 Futures and ETFs**



Source: S&P Dow Jones Indices LLC, FIA, Bloomberg, Bank for International Settlements (BIS), World Federation of Exchanges 2018 IOMA report (IOMA), Cboe annual listed securities report (Cboe), World Federation of Exchanges (WFE). Data as of Dec. 31, 2018. S&P DJI figure is the index equivalent trading volumes, all others as reported. Chart is provided for illustrative purposes.

## THE S&P 500 TRADING ECOSYSTEM

The S&P 500 offers an opportunity to study the putative network effects of liquidity; it contributes most of the volume in Exhibit 2, and provides the basis for a wide range of different products.

If there is a potential arbitrage link between two products—such as between two products tracking the same index—a liquid market in one can support pricing in the other. Beyond the simple links between products tracking the same index, connections can exist between different indices, creating a network of linked indices and products. **One example is provided by the S&P 500 and its sectors.** The additions and deletions to the benchmark are replicated at the sectoral level and, mixed in the correct proportions, a portfolio of sector products will track the benchmark. This makes arbitrage possible and creates a link in pricing and trading.

A more complicated link connects the S&P 500 to trading in products tracking the [Cboe Volatility Index® \(VIX\)](#). Based on the prices of listed S&P

*A liquid market in one product can support pricing in another.*

*The sector indices of the S&P 500 provide an example of simple connections between different indices...*

<sup>5</sup> In particular, Exhibit 3 displays index equivalent trading volumes recorded in calendar 2018, instead of the 12 months ending in June 2019 that were the subject of Exhibit 2.

...while VIX illustrates a more intricate relationship between different indices and products.

500 options, VIX represents the blended cost of insuring against moves in the S&P 500, derived from mathematical theories of option pricing. The associated VIX futures have developed their own market, used by those with existing options positions, and those who wish to express a view on future volatility expectations. The chain of connections from the S&P 500 index level, through options, via VIX and ending in VIX futures may involve some difficult calculus, but **short-term risk is often recycled from one market to the next in the chain.** Ultimately, these connections can lead to more efficient markets by improving the ability of market makers to narrow their quotes at both ends.<sup>6</sup>

**Exhibit 4: The S&P 500 Ecosystem – Aggregate Index Equivalent Trading Volume in Billions of U.S. Dollars**

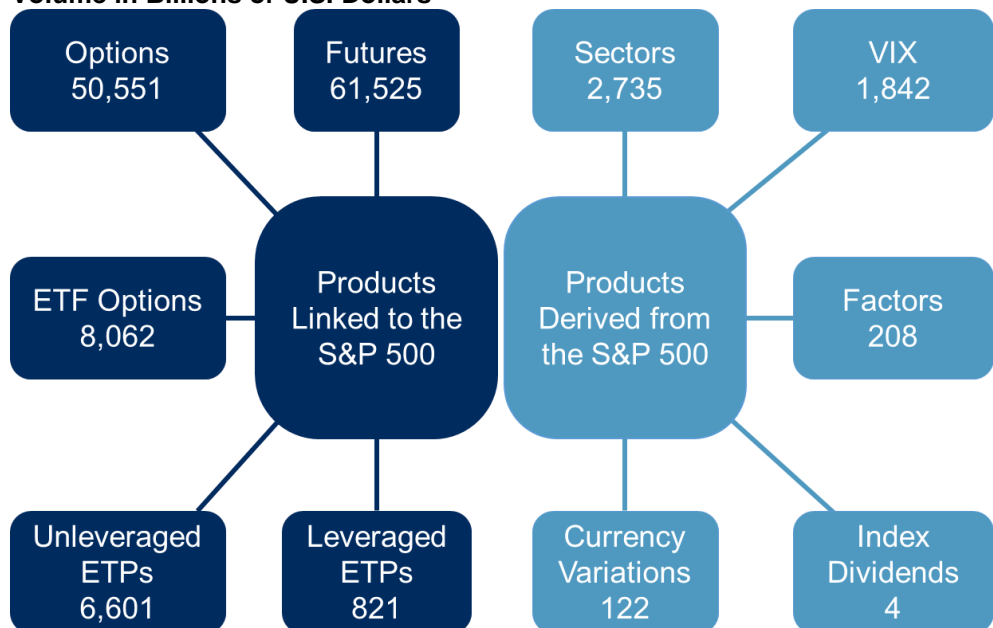


Exhibit 4 illustrates the conceptual “ecosystem” associated with the S&P 500.

Source: S&P Dow Jones Indices LLC, FIA, Bloomberg. Data from the 12-month-period ending June 30, 2019. Chart is provided for illustrative purposes. See Appendix for more details.

Exhibit 4 illustrates the conceptual “ecosystem” associated with the S&P 500, extending along different product lines and different—but related—indices. On the left side of Exhibit 4, we show the different products *tracking* the S&P 500, subdividing the columns of Exhibit 2 to provide slightly more granularity. On the right side of Exhibit 4, we show index equivalent trading in indices *derived from* the S&P 500, but with distinct index performance. The closest neighbors (in an index sense) include products traded in, or hedged into, different currencies. Indices based on the sectoral subindices of the S&P 500 provide another spoke, as do indices reflecting investment styles or factors (such as dividends or value) that are built from the constituents of the S&P 500. Indices tracking other

<sup>6</sup> At least, those market makers who can do calculus. The Cboe VIX methodology is available at <http://www.cboe.com/micro/vix/vix-index-rules-and-methodology.pdf>.

features of the benchmark index, such as volatility and dividends, complete the set—with the associated IET displayed for each category.

### COMPARISONS OF VOLUMES AND ASSETS

*It is natural to compare volumes with capital invested to deduce an average holding period...*

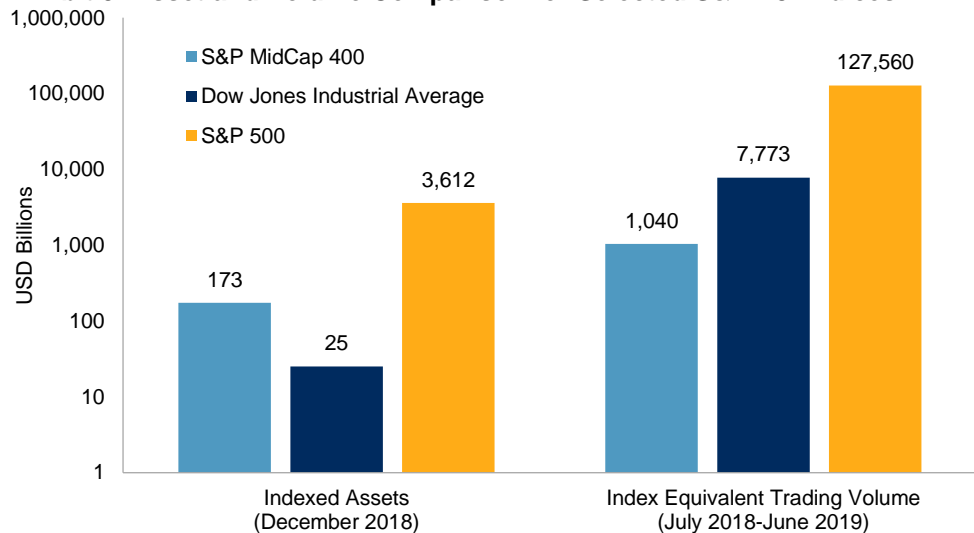
It is natural to compare trading volumes with some measure of outstanding interest or invested capital, and thus deduce the average holding period among market participants. We shall make such comparisons after first cautioning that any security can have a mix of investors who trade with different frequencies. If one investor turns over his position 100 times a day, and another 99 investors hold positions without ever trading them at all, it is arguably misleading (though computationally correct) to observe without qualification that, on average, investors trade once a day.<sup>7</sup>

*...even if a majority of investors trade less frequently than the average.*

Although the “average” investor’s trading might not be representative, comparisons between assets (or open interest) and volumes provide an insight into the degree of activity in each product.

Exhibit 5 compares the IET in three of S&P DJI’s broad U.S. equity indices, over the one-year period centered around Dec. 31, 2018, to the total amount invested in all products linked to those indices as of that date.<sup>8</sup>

**Exhibit 5: Asset and Volume Comparison for Selected S&P DJI Indices**



*Exhibit 5 shows that volumes exceed assets by an order of magnitude.*

Source: S&P Dow Jones Indices LLC, FIA, Bloomberg. Data as of June 30, 2019. Chart is provided for illustrative purposes. Note: logarithmic scale used for vertical axis.

Exhibit 5 shows—for the three selected indices—that **trading in index-linked products exceeded the value of assets invested in portfolios tracking those indices by an order of magnitude.** The data for the Dow

<sup>7</sup> We suspect a similar (if less extreme) distribution may prevail among the users of index-linked products.

<sup>8</sup> Indexed assets sourced from S&P DJI’s latest “[Annual Survey of Indexed Assets](#),” *op. cit.*; index equivalent trading volumes are for the 12-month period ending June 30, 2019, as reported in Exhibit 2. Note that the two sources of Exhibit 5 refer to an overlapping, but not identical, set of products; unlisted mutual funds are in the former but not the latter, and futures are not represented in indexed assets. Product-by-product comparisons are provided in Exhibit 6.

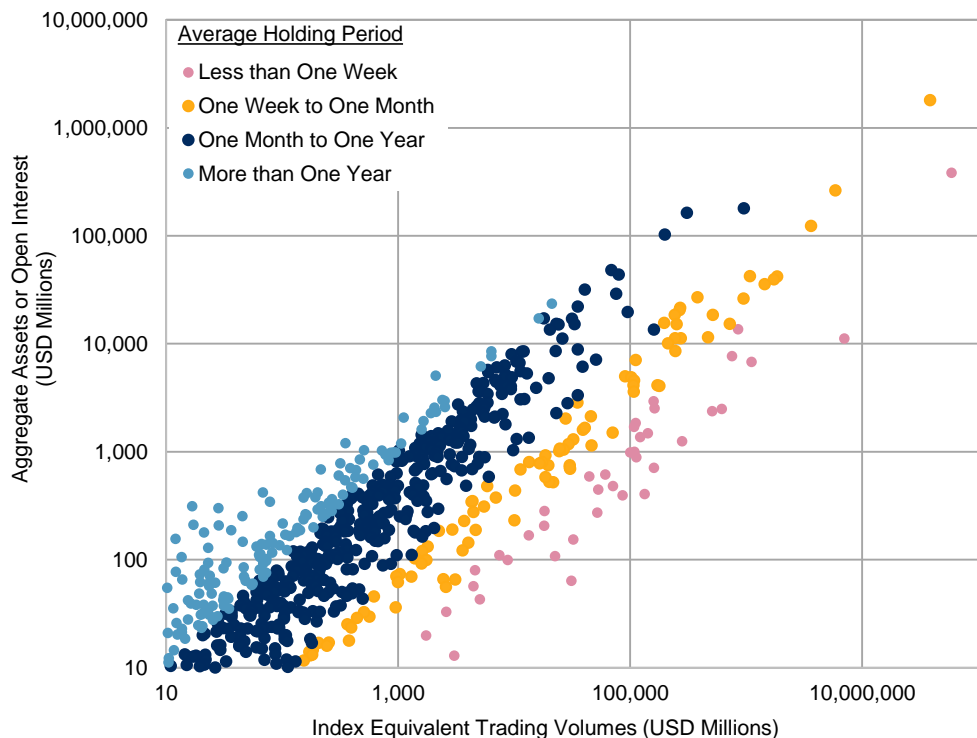
Jones Industrial Average were particularly striking. The Dow®'s importance as a trading vehicle is far larger than the value of assets held in trackers linked to The Dow would suggest.

For a broader and more granular examination, we can make product by product comparisons. To construct Exhibit 6, we limited the sample to ETPs, index-linked futures, and options for which average assets under management (or open interest) were available for the 12-month period ending in June 2019. In order to focus on products with at least a moderate degree of investor participation, we further limited the sample to those products with at least USD 10 million in both average assets and annual volumes.<sup>9</sup>

*A product by product comparison allows for more granular comparisons.*

Once filtered, Exhibit 6 compares the IET in each product to its average assets under management (or open interest in the case of futures and options), adjusted in the same manner as the IET.

**Exhibit 6: Assets versus IET in Products Linked to S&P DJI Indices**



*Exhibit 6 compares the average size of investor positioning in various index-linked products to each product's aggregate annual volume.*

Source: S&P Dow Jones Indices LLC, FIA, Bloomberg. Sample truncated at assets or IET volumes of less than USD 10 million. For each product, the average holding period is (assets/IET) x 365. Data as of June 30, 2019. Chart is provided for illustrative purposes. Note: logarithmic scale used for both axes.

*The vehicles may be passive, but some of their users are quite active.*

The holding periods in Exhibit 6 are colored according to the ratio of assets to volumes in each product. The median holding period across all the products in the exhibit was 174 calendar days, or around six months. Taking an average weighted by assets, due to the larger interest in the

<sup>9</sup> As stated earlier, futures and options data were sourced from the FIA, while ETP data were sourced from Bloomberg LLC.

most liquid products, the average holding period was much shorter—only 11 days.

Exhibit 6 illustrates that there was a moderately high average frequency of trading in a large number of products, relative to their outstanding assets; a monthly holding period was not uncommon. **The vehicles may be passive, but it's clear that their users can be quite active.**

## FINAL OBSERVATIONS

While trading in products linked to S&P DJI indices is modest in comparison to the broader derivatives markets, the volume of annual trading is large in absolute terms, and quite large in comparison to the assets invested in funds tracking the same indices. **The S&P DJI ecosystem, in other words, is notable for its liquidity.**

At least for frequent traders, liquidity is valuable in and of itself.<sup>10</sup> One recent survey of institutional ETF users ranked secondary market liquidity ahead of cost, and below only the choice of underlying index, as a criterion for selecting ETFs.<sup>11</sup>

Although higher product liquidity has an obvious benefit for market participants who trade frequently, **even relatively inactive investors stand to benefit**, both when they establish an initial position, but also — perhaps even more so—when they wish to exit that position, potentially years in the future.

Of course, high product volumes today do not guarantee competitive quotes tomorrow, but investors may view current levels and trends as an indication. With listed products that have a multi-decade record of attracting liquidity, based on benchmarks that have proved of interest to arbitrageurs and media for more than a century,<sup>12</sup> **S&P DJI has a strong record of supporting liquid index products.**

Accordingly, asset managers who chose to construct their own indices (or focus on less well-known benchmarks in order to save costs) potentially deny their clients the benefit of the market efficiencies associated with more popular benchmarks. Similarly, **users of index-based products may wish to consider the volumes associated with an index** as an important factor in choosing an appropriate product allocation.

*Trading in products linked to S&P DJI indices amounts to trillions of U.S. dollars.*

*Even long-term investors may benefit from the market efficiencies created within the S&P DJI ecosystem.*

*Asset managers who chose to construct their own indices potentially prevent their clients from sharing these benefits.*

<sup>10</sup> Khomyn, Marta and Talis J. Putnins, "The value of ETF liquidity," working paper, May 2019.

<sup>11</sup> Keefe, Bruyette & Woods "2<sup>nd</sup> Annual Institutional ETF Survey," 2019, cited in Bell, Heather, "[Institutions Still Wary Of ETFs](#)," ETF.com, July 26, 2019.

<sup>12</sup> S&P 500 index futures have been actively traded since 1982; the first ETF linked to the index arrived in 1993. While the S&P 500 (in its current form) was only launched in 1957, the fluctuations in The Dow averages have featured in the financial pages since the first edition of *The Wall Street Journal* in 1889.



## APPENDIX: METHODOLOGY

This appendix details the definition of “index equivalent trading volume,” outlines the sources used, and provides calculation details. We also indicate how products were selected or excluded from the total, and note the major sources of potential estimation error. Overall, it is likely that we *under-estimate* the degree of trading in index linked products, since not all potentially relevant products were included, and not all trading was captured.

Note that in many standard investment funds, investors subscribe to or redeem shares directly with the product issuer. The focus of this report is secondary market trading; primary market transactions are not included in the total.

### Index Equivalent Trading Volume (IET)

The IET was designed to capture the economic value of trading in index-linked products traded in aggregate. The key notion is what a market-maker might do to hedge her exposures on a trade-by-trade basis. We assume—for purposes of calculating the IET—that products track their associated indices “as advertised” and ignore the potential effects of tracking error in index-linked products or their potential hedges.

An illustrative example: if 100 shares of an ETF trade at a price of \$200 per share, the associated IET is \$20,000. Similarly, the IET associated with each futures trade is provided by the number of contracts traded, times the futures price, times the contract size.

For leveraged and inverse ETFs, the value traded in the underlying product is multiplied by the absolute value of the appropriate leverage multiple. Thus, 100 shares in a double inverse leveraged ETF traded at \$200 would correspond to \$40,000 in IET.

In the case of options, to obtain an estimate of the IET, we multiply the aggregate traded option notional by 0.4. An option with a notional of 100 shares traded on the first ETF above, for example, would have an IET of \$8,000.

The assumption of 0.4 for the average option’s sensitivity to its index (“delta”) is crude but, since we sum over millions of transactions, it is sufficient to know only the average. The figure of 0.4 reflects a situation where most options trade close to “at the money,” but with a bias towards “out of the money.” The figure also fits an interpolated mean of the figures provided in Hu (2014) for U.S. equity options.<sup>13</sup>

Finally, trade at settlement (TAS) and basis trade at index close (BTIC) transactions were treated as equivalent to trades in the underlying future in order to calculate the IET.

### Sources and Calculation

Monthly volumes and open interest for futures and listed options were sourced from the Futures Industry Association (FIA), with the index equivalent trading volume calculated via the average reference index level in each month, and then aggregated to produce an annual figure. Where FIA data were unavailable, data from the various exchanges were substituted.

<sup>13</sup> Hu, Jianfeng, “[Does Option Trading Convey Stock Price Information?](#)” *Journal of Financial Economics*, March 2014.

Cumulative trading volumes and average assets under management for other ETPs (including ETFs and listed options on ETFs) were sourced from Bloomberg LLC. Monthly aggregate volumes in other currencies were converted into U.S. dollars at that month's average exchange rate, so that all figures in this report are in U.S. dollars.

### **Product Inclusion and Aggregation by Index**

1,368 distinct products were included, many of which were associated with multiple trading lines. The initial universe of products was determined by S&P DJI, and represents the range of licensed products as of June 30, 2019.

The list of products was filtered to exclude (1) actively managed products benchmarked to S&P DJI indices, (2) flexible exchange options ("flex" options) and listed certificates, (3) over-the-counter transactions such as swaps, even if reported and centrally cleared, and (4) products linked to "custom" indices that S&P DJI calculates on behalf of a third party.

For some benchmark indices, a wide range of related indices expresses various aspects of the same benchmark return. For example, S&P DJI produces index levels for the S&P 500 expressed in (or hedged into) a range of currencies, potentially including or excluding dividends, or including dividends only net of withholding taxes. For the purposes of producing Exhibit 2, different currency and currency-hedged, and price, net, and total return versions of each index are aggregated to the same benchmark index. In Exhibit 4, different currency lines associated with the S&P 500 can occur twice—once on both sides of the exhibit.

Indices that differ in their underlying constituents or weights were counted separately. For example, trades in products linked to the [S&P 500 Equal Weight Index](#) were not included in the total associated with the S&P 500 (although they contributed to the right side of Exhibit 4 under "factors").

### **Biases**

The survey is subject to both survivorship and reporting biases. Both are estimated to be of secondary or tertiary importance with respect to the overall total, but could have meaningful impact within individual market segments, and may be more significant when making comparisons to previous years.

Products previously linked to S&P DJI indices that de-listed or switched their benchmark prior to June 2019 were not included in the total. Conversely, products that were linked to S&P DJI indices as of June 2019, but which tracked different indices previously, were included in the total.

More significantly, while U.S. regulators have for many years required all trades in U.S.-domiciled ETFs to be reported (and a "consolidated tape" is available), trade reporting requirements in European-domiciled ETFs were introduced only recently. Due to the significant changes in reporting requirements for European ETFs in particular, but also for products listed in other global markets where regulations have changed, comparisons between current volumes and previous years may be illustrative of broader trends, but may not provide "apples-to-apples" comparisons.

<b>S&amp;P DJI RESEARCH CONTRIBUTORS</b>		
Sunjiv Mainie, CFA, CQF	Global Head	<a href="mailto:sunjiv.mainie@spglobal.com">sunjiv.mainie@spglobal.com</a>
Jake Vukelic	Business Manager	<a href="mailto:jake.vukelic@spglobal.com">jake.vukelic@spglobal.com</a>
<b>GLOBAL RESEARCH &amp; DESIGN</b>		
<b>AMERICAS</b>		
Sunjiv Mainie, CFA, CQF	Americas Head	<a href="mailto:sunjiv.mainie@spglobal.com">sunjiv.mainie@spglobal.com</a>
Laura Assis	Analyst	<a href="mailto:laura.assis@spglobal.com">laura.assis@spglobal.com</a>
Cristopher Anguiano, FRM	Analyst	<a href="mailto:cristopher.anguiano@spglobal.com">cristopher.anguiano@spglobal.com</a>
Phillip Brzenk, CFA	Senior Director	<a href="mailto:phillip.brzenk@spglobal.com">phillip.brzenk@spglobal.com</a>
Smita Chirputkar	Director	<a href="mailto:smita.chirputkar@spglobal.com">smita.chirputkar@spglobal.com</a>
Rachel Du	Senior Analyst	<a href="mailto:rachel.du@spglobal.com">rachel.du@spglobal.com</a>
Bill Hao	Director	<a href="mailto:wenli.hao@spglobal.com">wenli.hao@spglobal.com</a>
Qing Li	Director	<a href="mailto:qing.li@spglobal.com">qing.li@spglobal.com</a>
Berlinda Liu, CFA	Director	<a href="mailto:berlinda.liu@spglobal.com">berlinda.liu@spglobal.com</a>
Hamish Preston	Associate Director	<a href="mailto:hamish.preston@spglobal.com">hamish.preston@spglobal.com</a>
Maria Sanchez	Associate Director	<a href="mailto:maria.sanchez@spglobal.com">maria.sanchez@spglobal.com</a>
Kunal Sharma	Senior Analyst	<a href="mailto:kunal.sharma@spglobal.com">kunal.sharma@spglobal.com</a>
Hong Xie, CFA	Senior Director	<a href="mailto:hong.xie@spglobal.com">hong.xie@spglobal.com</a>
<b>APAC</b>		
Priscilla Luk	APAC Head	<a href="mailto:priscilla.luk@spglobal.com">priscilla.luk@spglobal.com</a>
Arpit Gupta	Senior Analyst	<a href="mailto:arpit.gupta1@spglobal.com">arpit.gupta1@spglobal.com</a>
Akash Jain	Associate Director	<a href="mailto:akash.jain@spglobal.com">akash.jain@spglobal.com</a>
Anurag Kumar	Senior Analyst	<a href="mailto:anurag.kumar@spglobal.com">anurag.kumar@spglobal.com</a>
Xiaoya Qu	Senior Analyst	<a href="mailto:xiaoya.qu@spglobal.com">xiaoya.qu@spglobal.com</a>
Yan Sun	Senior Analyst	<a href="mailto:yan.sun@spglobal.com">yan.sun@spglobal.com</a>
Tim Wang	Senior Analyst	<a href="mailto:tim.wang@spglobal.com">tim.wang@spglobal.com</a>
Liyu Zeng, CFA	Director	<a href="mailto:liyu.zeng@spglobal.com">liyu.zeng@spglobal.com</a>
<b>EMEA</b>		
Andrew Innes	EMEA Head	<a href="mailto:andrew.innes@spglobal.com">andrew.innes@spglobal.com</a>
Leonardo Cabrer, PhD	Senior Analyst	<a href="mailto:leonardo.cabrer@spglobal.com">leonardo.cabrer@spglobal.com</a>
Andrew Cairns	Senior Analyst	<a href="mailto:andrew.cairns@spglobal.com">andrew.cairns@spglobal.com</a>
Jingwen Shi	Analyst	<a href="mailto:jingwen.shi@spglobal.com">jingwen.shi@spglobal.com</a>
<b>INDEX INVESTMENT STRATEGY</b>		
Craig J. Lazzara, CFA	Global Head	<a href="mailto:craig.lazzara@spglobal.com">craig.lazzara@spglobal.com</a>
Chris Bennett, CFA	Director	<a href="mailto:chris.bennett@spglobal.com">chris.bennett@spglobal.com</a>
Fei Mei Chan	Director	<a href="mailto:feimei.chan@spglobal.com">feimei.chan@spglobal.com</a>
Tim Edwards, PhD	Managing Director	<a href="mailto:tim.edwards@spglobal.com">tim.edwards@spglobal.com</a>
Anu R. Ganti, CFA	Director	<a href="mailto:anu.ganti@spglobal.com">anu.ganti@spglobal.com</a>
Sherifa Issifu	Analyst	<a href="mailto:sherifa.issifu@spglobal.com">sherifa.issifu@spglobal.com</a>
Howard Silverblatt	Senior Index Analyst	<a href="mailto:howard.silverblatt@spglobal.com">howard.silverblatt@spglobal.com</a>

## GENERAL DISCLAIMER

Copyright © 2019 S&P Dow Jones Indices LLC. All rights reserved. STANDARD & POOR'S, S&P, S&P 500, S&P 500 LOW VOLATILITY INDEX, S&P 100, S&P COMPOSITE 1500, S&P MIDCAP 400, S&P SMALLCAP 600, S&P GIVI, GLOBAL TITANS, DIVIDEND ARISTOCRATS, S&P TARGET DATE INDICES, GICS, SPIVA, SPDR and INDEXOLOGY are registered trademarks of Standard & Poor's Financial Services LLC, a division of S&P Global ("S&P"). DOW JONES, DJ, DJIA and DOW JONES INDUSTRIAL AVERAGE are registered trademarks of Dow Jones Trademark Holdings LLC ("Dow Jones"). These trademarks together with others have been licensed to S&P Dow Jones Indices LLC. Redistribution or reproduction in whole or in part are prohibited without written permission of S&P Dow Jones Indices LLC. This document does not constitute an offer of services in jurisdictions where S&P Dow Jones Indices LLC, S&P, Dow Jones or their respective affiliates (collectively "S&P Dow Jones Indices") do not have the necessary licenses. Except for certain custom index calculation services, all information provided by S&P Dow Jones Indices is impersonal and not tailored to the needs of any person, entity or group of persons. S&P Dow Jones Indices receives compensation in connection with licensing its indices to third parties and providing custom calculation services. Past performance of an index is not an indication or guarantee of future results.

It is not possible to invest directly in an index. Exposure to an asset class represented by an index may be available through investable instruments based on that index. S&P Dow Jones Indices does not sponsor, endorse, sell, promote or manage any investment fund or other investment vehicle that is offered by third parties and that seeks to provide an investment return based on the performance of any index. S&P Dow Jones Indices makes no assurance that investment products based on the index will accurately track index performance or provide positive investment returns. S&P Dow Jones Indices LLC is not an investment advisor, and S&P Dow Jones Indices makes no representation regarding the advisability of investing in any such investment fund or other investment vehicle. A decision to invest in any such investment fund or other investment vehicle should not be made in reliance on any of the statements set forth in this document. Prospective investors are advised to make an investment in any such fund or other vehicle only after carefully considering the risks associated with investing in such funds, as detailed in an offering memorandum or similar document that is prepared by or on behalf of the issuer of the investment fund or other investment product or vehicle. S&P Dow Jones Indices LLC is not a tax advisor. A tax advisor should be consulted to evaluate the impact of any tax-exempt securities on portfolios and the tax consequences of making any particular investment decision. Inclusion of a security within an index is not a recommendation by S&P Dow Jones Indices to buy, sell, or hold such security, nor is it considered to be investment advice. Closing prices for S&P Dow Jones Indices' US benchmark indices are calculated by S&P Dow Jones Indices based on the closing price of the individual constituents of the index as set by their primary exchange. Closing prices are received by S&P Dow Jones Indices from one of its third party vendors and verified by comparing them with prices from an alternative vendor. The vendors receive the closing price from the primary exchanges. Real-time intraday prices are calculated similarly without a second verification.

These materials have been prepared solely for informational purposes based upon information generally available to the public and from sources believed to be reliable. No content contained in these materials (including index data, ratings, credit-related analyses and data, research, valuations, model, software or other application or output therefrom) or any part thereof ("Content") may be modified, reverse-engineered, reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without the prior written permission of S&P Dow Jones Indices. The Content shall not be used for any unlawful or unauthorized purposes. S&P Dow Jones Indices and its third-party data providers and licensors (collectively "S&P Dow Jones Indices Parties") do not guarantee the accuracy, completeness, timeliness or availability of the Content. S&P Dow Jones Indices Parties are not responsible for any errors or omissions, regardless of the cause, for the results obtained from the use of the Content. THE CONTENT IS PROVIDED ON AN "AS IS" BASIS. S&P DOW JONES INDICES PARTIES DISCLAIM ANY AND ALL EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE, FREEDOM FROM BUGS, SOFTWARE ERRORS OR DEFECTS, THAT THE CONTENT'S FUNCTIONING WILL BE UNINTERRUPTED OR THAT THE CONTENT WILL OPERATE WITH ANY SOFTWARE OR HARDWARE CONFIGURATION. In no event shall S&P Dow Jones Indices Parties be liable to any party for any direct, indirect, incidental, exemplary, compensatory, punitive, special or consequential damages, costs, expenses, legal fees, or losses (including, without limitation, lost income or lost profits and opportunity costs) in connection with any use of the Content even if advised of the possibility of such damages.

S&P Global keeps certain activities of its various divisions and business units separate from each other in order to preserve the independence and objectivity of their respective activities. As a result, certain divisions and business units of S&P Global may have information that is not available to other business units. S&P Global has established policies and procedures to maintain the confidentiality of certain non-public information received in connection with each analytical process.

In addition, S&P Dow Jones Indices provides a wide range of services to, or relating to, many organizations, including issuers of securities, investment advisers, broker-dealers, investment banks, other financial institutions and financial intermediaries, and accordingly may receive fees or other economic benefits from those organizations, including organizations whose securities or services they may recommend, rate, include in model portfolios, evaluate or otherwise address.

Cboe and VIX are registered trademarks of Cboe Exchange, Inc. and have been licensed for use by S&P Dow Jones Indices.