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# Incorporating Liquidity Measures in Constructing a Corporate Bond Index

## INTRODUCTION

Much has been written about the tradability and investability challenges of broad-based fixed income indices that contain thousands of bonds. Traditionally, fund managers seeking to replicate the returns of such indices typically choose a sample, holding a small fraction of the bonds. Tracking error to the benchmark may be managed by matching key risk characteristics, such as credit rating, sector, duration, convexity, and yield-to-maturity of liquid and available bonds.

In this paper, we examine liquidity criteria that can potentially be used in the construction of replicable and liquid fixed income indices. We used the [S&P 500<sup>®</sup> Investment Grade Corporate Bond Index](#), which contains more than 4,500 bonds and can therefore face the aforementioned replicability challenges, to guide the development of a framework for forming a narrower, investable basket. We then compare the liquidity profile of the resulting index, the [S&P/MarketAxess Investment Grade Corporate Bond Index](#), to the benchmark.

In assessing the relative liquidity of bonds, we examine the strength of commonly used indicators, such as size and age, against Trade Reporting and Compliance Engine (TRACE) corporate bond transaction data. Additionally, we examine the persistence of TRACE-based liquidity signals over time to develop a systematic approach in constructing a tradable subset while controlling for turnover.

## METHODOLOGY

Liquidity may be defined as the ability to buy or sell an asset within a reasonable period of time with limited price disruption. Several methods exist to assess an asset's liquidity. A simple way to compare the liquidity of two bonds is through the use of TRACE daily volume data. The data represents the daily aggregation of each reported trade throughout the day. The existence of reported volume data can be indicative of the frequency of trading. For example, if a bond has volume data for 20 of the last 22 trading days, then it trades relatively frequently—nearly every day.

The volume data itself can also indicate the size in which it trades daily. For two bonds, we can compare the turnover rate, defined as the total volume traded in 22 days as a percentage of the amount outstanding. For example, a bond may be considered more liquid relative to another one if a larger portion of its total outstanding is traded over a one-month period.

However, if a large holding of an asset is sold quickly but at a significant loss, the proposed measure will inaccurately indicate the position as being liquid. In addition to considering volume and frequency, daily price changes or bid-offer spreads can be key indicators, particularly over periods of acute stress. Furthermore, granular data, such as intraday trade details (size and bid-offer spread), could help improve the analysis in determining relative bond liquidity.

Our study focuses on the simpler approach of comparing frequency and turnover to assess relative liquidity.

We began by evaluating the liquidity profile of the [S&P 500 Investment Grade Corporate Bond Index](#) in relation to that of the broader U.S. investment-grade corporate bond universe (excluding those in the [S&P 500](#)), using frequency of trading and turnover metrics. We then tested to see if the size and age of a bond could result in meaningful differences in its liquidity. Based on the results, we formed a hypothetical portfolio that was intended to be more tradable and liquid than its underlying index.

The liquidity analysis was conducted using TRACE end-of-day cumulative volume data from FactSet, which covers 8,800 of the most heavily traded corporate, agency, and 144a issues domiciled in the U.S.<sup>1</sup> Historical data is available on a daily basis beginning on Dec. 31, 2008.

In addition to considering volume and frequency, daily price changes or bid-offer spreads can be key indicators, particularly over periods of acute stress.

## **S&P 500 INVESTMENT GRADE CORPORATE BOND INDEX**

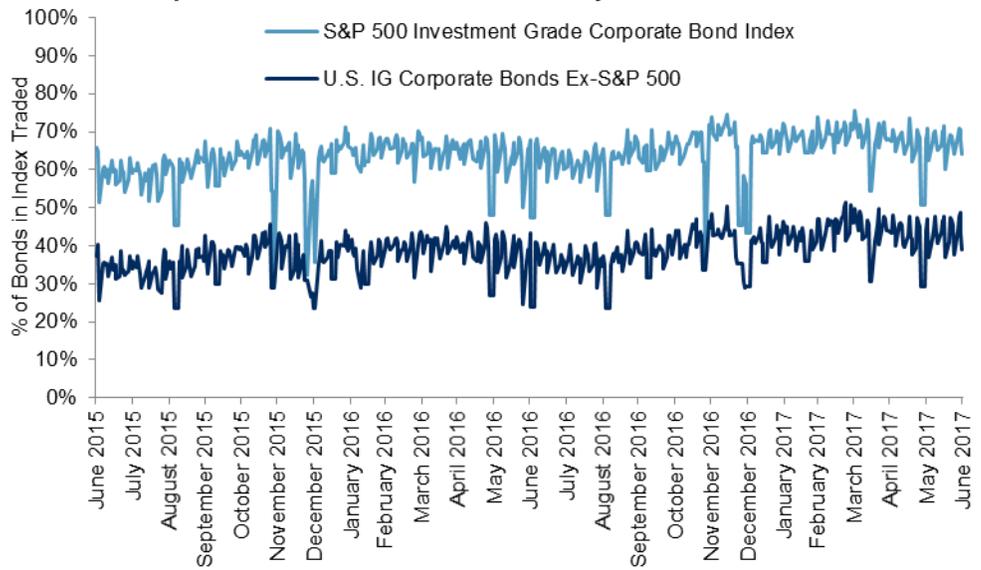
The S&P 500 Investment Grade Corporate Bond Index is designed to measure the performance of the investment-grade debt issued by the constituents of the S&P 500. Compared with the broader U.S. corporate bond market, the bonds issued by S&P 500 companies tend to have household name recognition. The bonds in the S&P 500 Investment Grade Corporate Bond Index have a minimum trade size of 1,000, with only a handful of instruments subject to private placement rules.

The constituents in the S&P 500 Investment Grade Corporate Bond Index trade more frequently than the universe of U.S. investment-grade corporate bonds excluding the S&P 500 (U.S. IG corporate bonds ex-S&P 500). Over the past two years, on average, 64% of the bonds in the S&P 500 Investment Grade Corporate Bond Index traded every day, versus 39% in

<sup>1</sup> TRACE volume data is reported with a cap of USD 5 million for USIG. Trades that are larger than USD 5 million in size are reported as USD 5 million.

the U.S. IG corporate bonds ex-S&P 500 (see Exhibit 1). Over the same period, 96% of the bonds in the index traded at least once each month, versus the U.S. IG corporate bonds ex-S&P 500 at 88% (see Exhibit 2). For the first half of 2017, the statistic is 99% for [S&P 500 Investment Grade Corporate Bond Index](#) constituents—that is to say, almost all of the bonds in the index traded at least once a month.

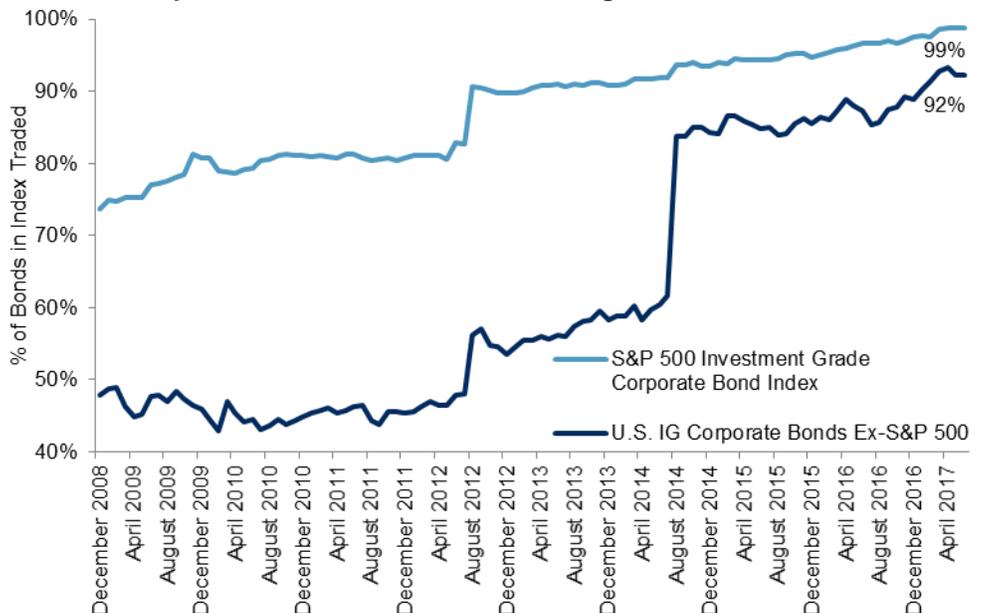
**Exhibit 1: Proportion of Bonds Traded Each Day**



For the first half of 2017, almost all of the bonds in the S&P 500 Investment Grade Corporate Bond Index traded at least once a month.

Source: S&P Dow Jones Indices LLC, FINRA. Data as of June 30, 2017. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

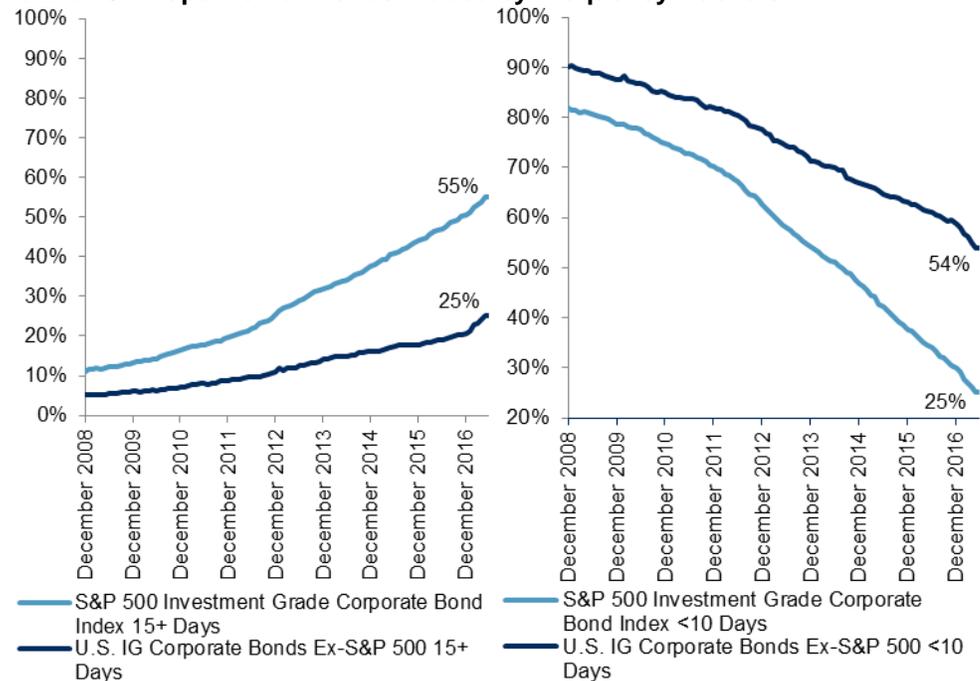
**Exhibit 2: Proportion of Bonds Traded in Trailing One-Month Period**



Source: S&P Dow Jones Indices LLC, FINRA. Data as of June 30, 2017. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

Furthermore, over one-half of bonds in the index traded on most days. Exhibit 3 shows the time series of proportion of the index traded by frequency over a 30-business-day look-back period; 55% of bonds traded nearly every day (15 or more trading days per month), while only about one-quarter of the bonds traded on fewer than 10 trading days in a one-month period.

**Exhibit 3: Proportion of Bonds Traded by Frequency Buckets**

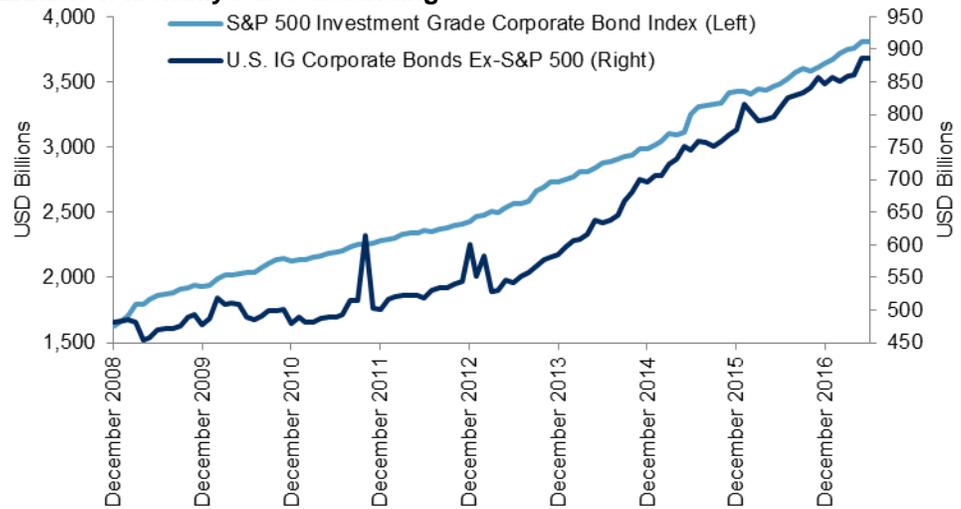


For the S&P 500 Investment Grade Corporate Bond Index, issuance has outpaced the increase in trade volume.

Source: S&P Dow Jones Indices LLC, FINRA. Data as of June 30, 2017. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

For the [S&P 500 Investment Grade Corporate Bond Index](#), issuance has outpaced the increase in trade volume. As of June 30, 2017, total debt outstanding among investment-grade S&P 500 companies stood at about USD 3.8 trillion, compared with USD 1.6 trillion at the end of 2008. U.S. IG corporate bonds ex-S&P 500 had a total notional outstanding of around USD 885.7 billion as of June 30, 2017, less than double the USD 480.7 billion notional outstanding at the end of 2008 (Exhibit 4).

**Exhibit 4: Monthly Par Outstanding**

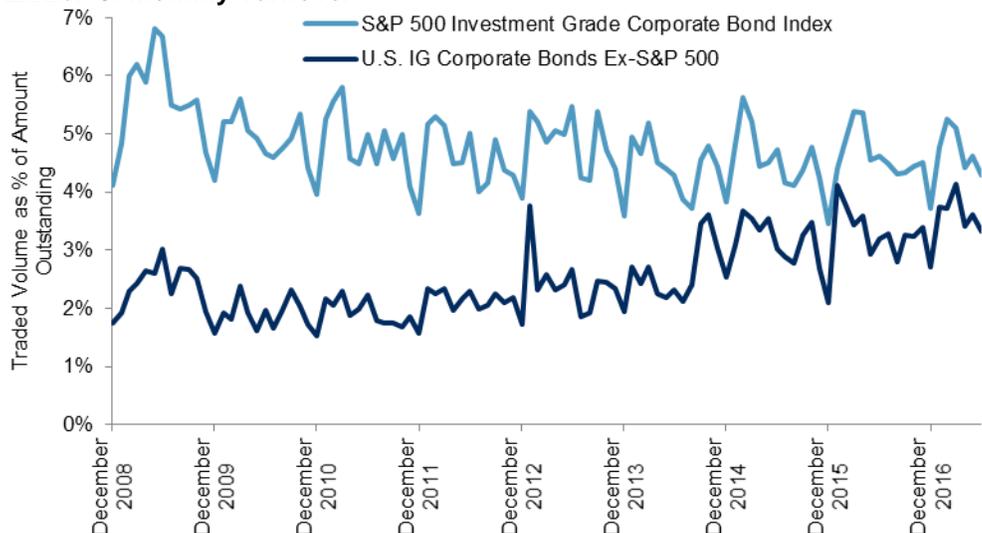


Source: S&P Dow Jones Indices LLC, FINRA. Data as of June 30, 2017. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

On average, the constituents of the [S&P 500 Investment Grade Corporate Bond Index](#) had 30% higher turnover than U.S. IG corporate bonds ex-S&P 500. Despite an improvement in trading volume for U.S. IG corporate bonds ex-S&P 500 since 2008, turnover still lagged the S&P 500 bonds. Exhibit 5 shows the trend in volume as a percentage of amount outstanding (turnover rate). Based on current turnover figures, it would take about 22 months (4.5% per month) to turn over the entire USD 3.8 trillion S&P 500 Investment Grade Corporate Bond Index, while it would take eight months longer (2.7% per month) to turn over the USD 0.89 trillion that makes up the U.S. IG corporate bonds ex-S&P 500.

On average, the constituents of the S&P 500 Investment Grade Corporate Bond Index had 30% higher turnover than U.S. IG corporate bonds ex-S&P 500.

**Exhibit 5: Monthly Turnover**



Source: S&P Dow Jones Indices LLC, FINRA. Data as of June 30, 2017. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

## LIQUID BONDS IN THE S&P 500 BOND INDEX

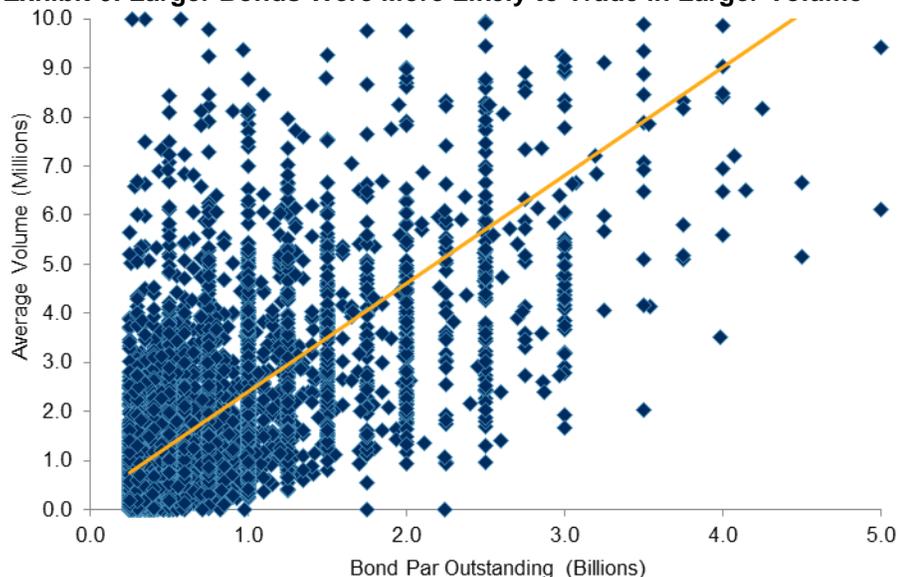
In this section, we explore characteristics of bonds that may be indicative of liquidity in order to develop a rules-based approach for limiting the tradable universe to a liquid subset of the [S&P 500 Investment Grade Corporate Bond Index](#).

As we noted earlier, fixed income index funds are constrained by the availability and liquidity of bonds that are in the underlying fixed income benchmarks. Funds may potentially hold a fraction of assets in the headline index and manage tracking error to the benchmark by matching the risk/return profile of the index. In the selection process, market participants often follow some guidelines such as size and age. For example, they may prefer more recently issued bonds, which tend to be more actively traded in the secondary market and could potentially have additional primary supply in the issuance pipeline. We explored bond characteristics such as size and age along with their impact on liquidity, as defined previously by frequency of trading and turnover.

Larger-sized bonds tended to trade in relatively larger volume and with a higher frequency.

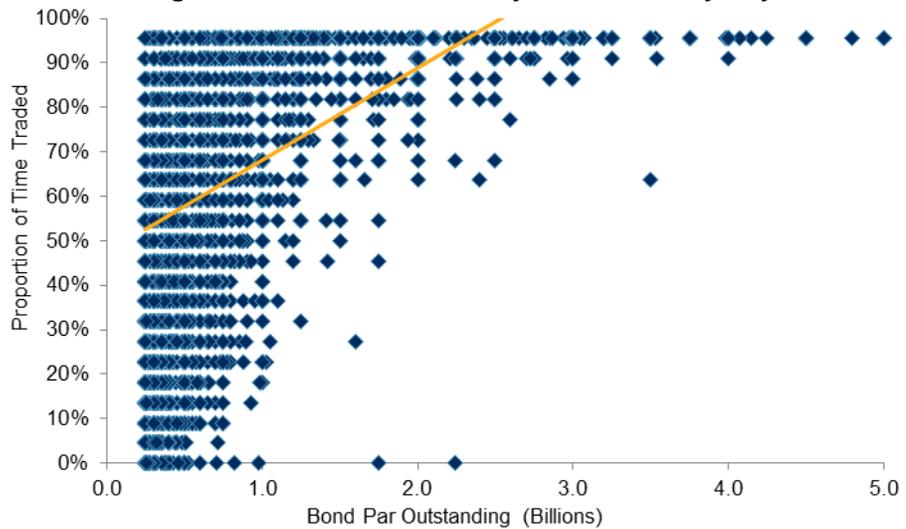
Larger-sized bonds tended to trade in relatively larger volume and with a higher frequency. The rationale is rather straightforward. Bonds with more supply in the market are likely to change hands more often or in larger amounts. Exhibit 6 highlights the positive relationship between average daily volume traded over a one-month period versus bond size using the composition on June 15, 2017. It is worth noting that the pattern persisted regardless of the specific date or lookback window. Furthermore, we found that the frequency of trades reinforced the story—larger bonds were more likely to trade on a daily basis than smaller bonds (see Exhibit 7).

**Exhibit 6: Larger Bonds Were More Likely to Trade in Larger Volume**



Source: S&P Dow Jones Indices LLC, FINRA. Data as of June 15, 2017. Past performance is no guarantee of future results. Chart is provided for illustrative purposes.

**Exhibit 7: Larger Bonds Were More Likely to Trade Every Day**

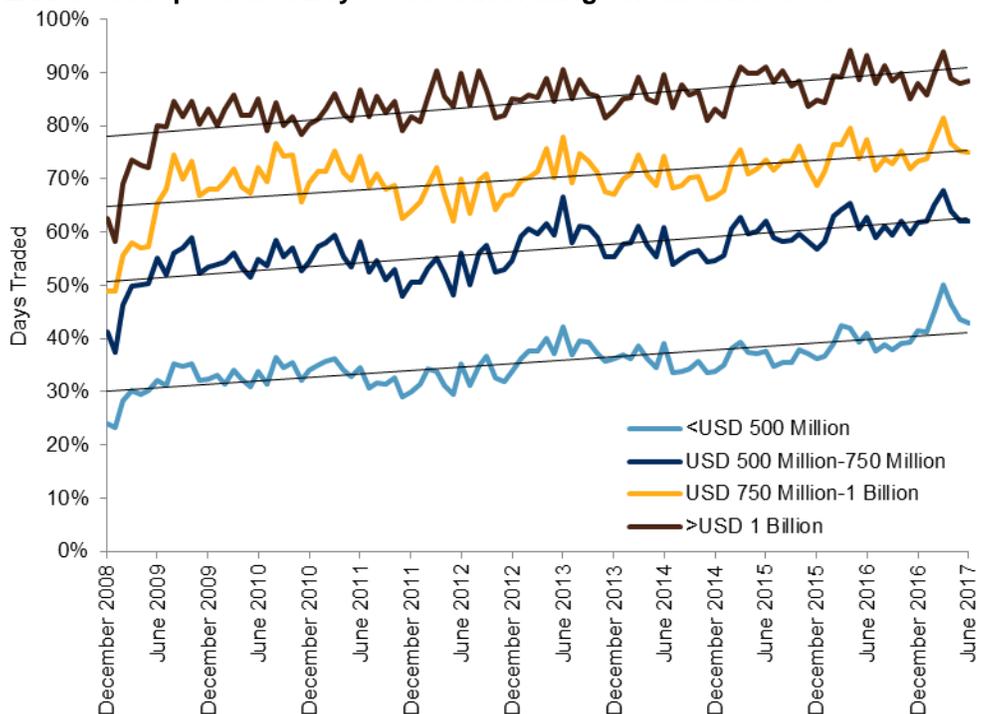


Source: S&P Dow Jones Indices LLC, FINRA. Data as of June 15, 2017. Past performance is no guarantee of future results. Chart is provided for illustrative purposes.

In general, the largest bonds traded nearly every day, while the smallest bonds traded fewer than one-half of the days.

We examined the relationship over time by dividing the universe into four groups based on par amount outstanding. Exhibit 8 shows the average frequency of traded days over a trailing one-month period for each group. We can see that, in general, the largest bonds (par outstanding greater than USD 1 billion) traded nearly every day, while the smallest bonds (par outstanding less than USD 500 million) traded fewer than one-half of the days.

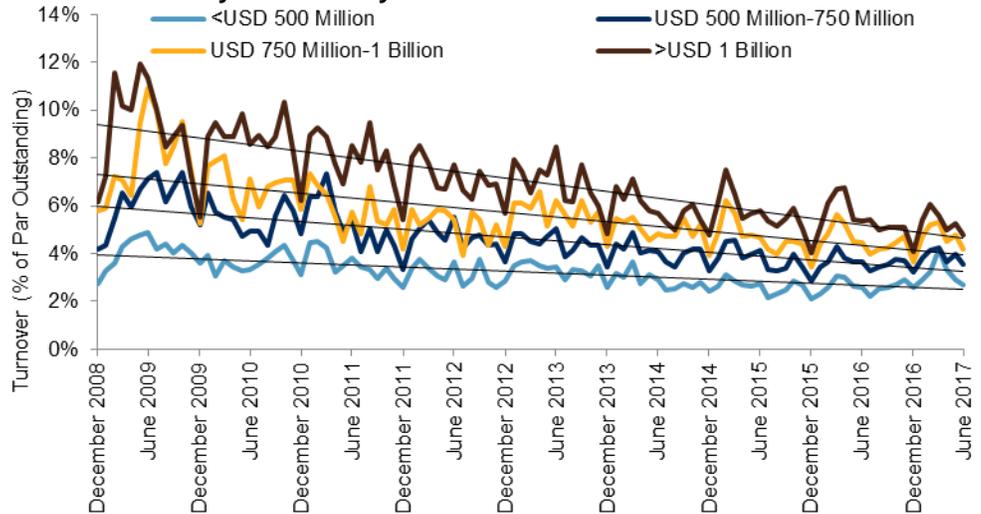
**Exhibit 8: Proportion of Days Traded in Trailing One-Month Period**



Source: S&P Dow Jones Indices LLC, FINRA. Data as of June 30, 2017. Past performance is no guarantee of future results. Chart is provided for illustrative purposes.

Larger bonds also had a higher turnover rate. Exhibit 9 plots the cumulative volume as a proportion of par outstanding over a one-month period. In June 2016, 5% of the total amount outstanding of the largest bonds was traded, while only about 3% of the smallest bonds changed hands.

**Exhibit 9: Monthly Turnover by Bond Size**

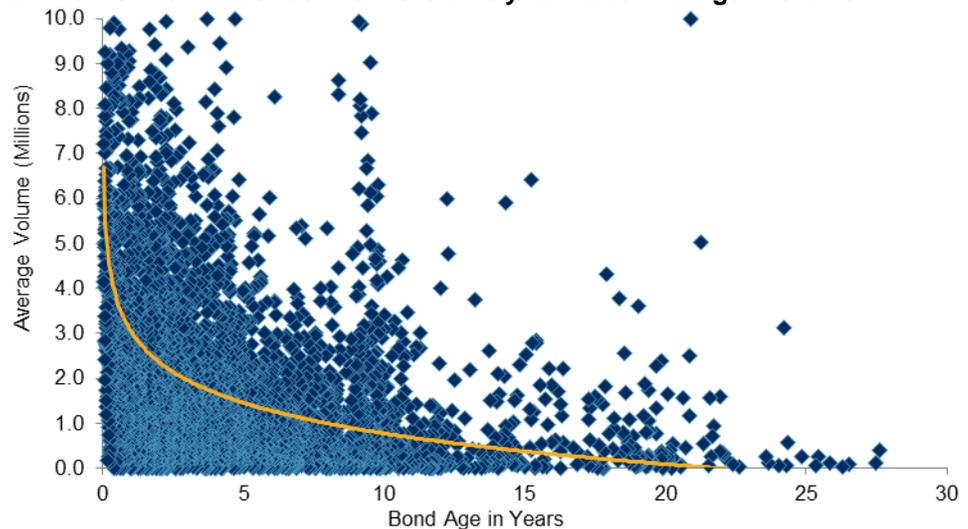


Newer bonds tended to trade in relatively larger volume and with a higher frequency.

Source: S&P Dow Jones Indices LLC, FINRA. Data as of June 30, 2017. Past performance is no guarantee of future results. Chart is provided for illustrative purposes.

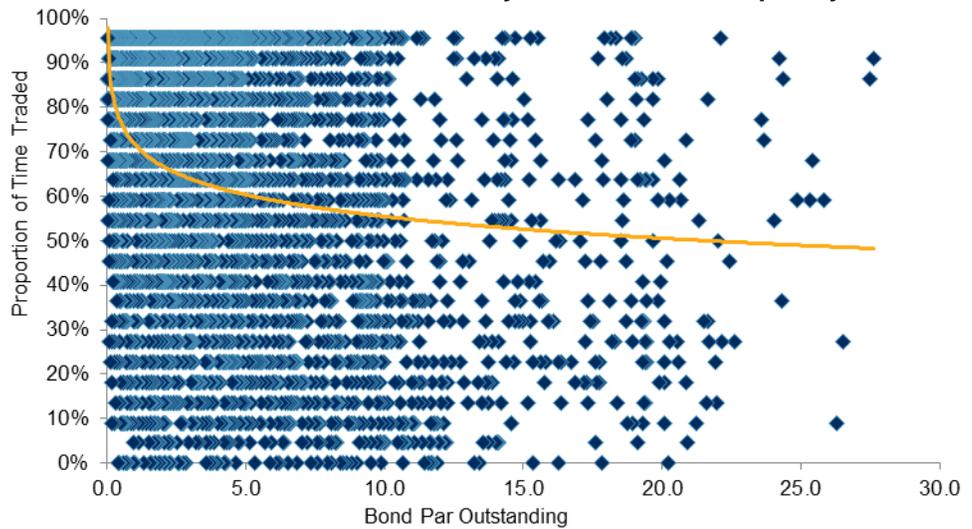
Newer bonds tended to trade in relatively larger volume and with a higher frequency. Exhibit 10 highlights the relationship between average daily volume traded over a one-month period versus bond age, using the composition on June 15, 2017. Again, we note that the pattern persisted regardless of the specific date or lookback window. The frequency of trades reinforced the relationship—newer bonds were more likely to trade on a daily basis than older bonds (see Exhibit 7).

**Exhibit 10: Newer Bonds Are More Likely to Trade in Larger Volume**



Source: S&P Dow Jones Indices LLC, FINRA. Data as of June 15, 2017. Past performance is no guarantee of future results. Chart is provided for illustrative purposes.

**Exhibit 11: Newer Bonds Are More Likely to Trade More Frequently**

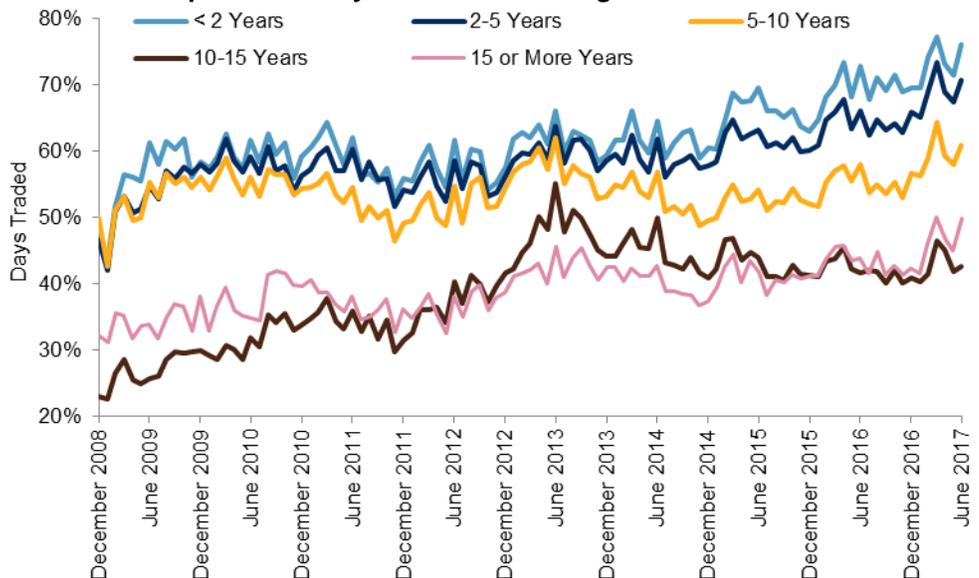


In June 2017, the newest bond group traded four out of five trading days, while the older bonds traded two out of five trading days.

Source: S&P Dow Jones Indices LLC, FINRA. Data as of June 15, 2017. Past performance is no guarantee of future results. Chart is provided for illustrative purposes.

We examined the relationship over time by dividing the index into five groups based on time since issuance (age). Exhibit 12 shows the average frequency of traded days in a one-month period for each group. In general, the newest bonds traded more frequently than the older bonds. For example, in June 2017, the newest bond group (age less than two years) traded four out of five trading days, while the older bonds (age greater than 10 years) traded two out of five trading days.

**Exhibit 12: Proportion of Days Traded in Trailing One-Month Period**

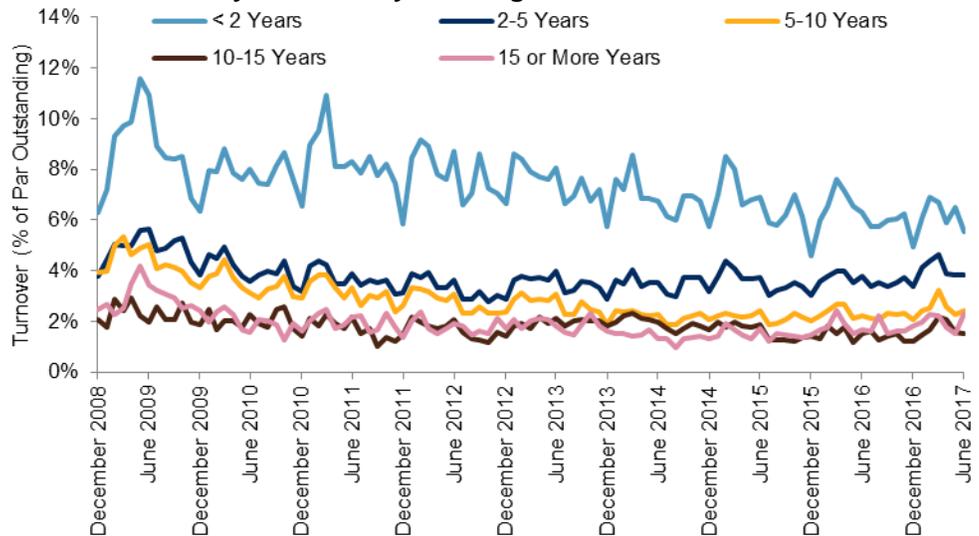


Source: S&P Dow Jones Indices LLC, FINRA. Data as of June 30, 2017. Past performance is no guarantee of future results. Chart is provided for illustrative purposes.

Newer bonds also had a significantly higher turnover rate. Exhibit 13 plots the cumulative volume as a proportion of par outstanding over a trailing one-month period. In June 2017, about 6% of the total outstanding

changed hands for bonds issued in the past two years, while only about 1.5% of bonds issued more than 10 years ago changed hands.

**Exhibit 13: Monthly Turnover by Bond Age**

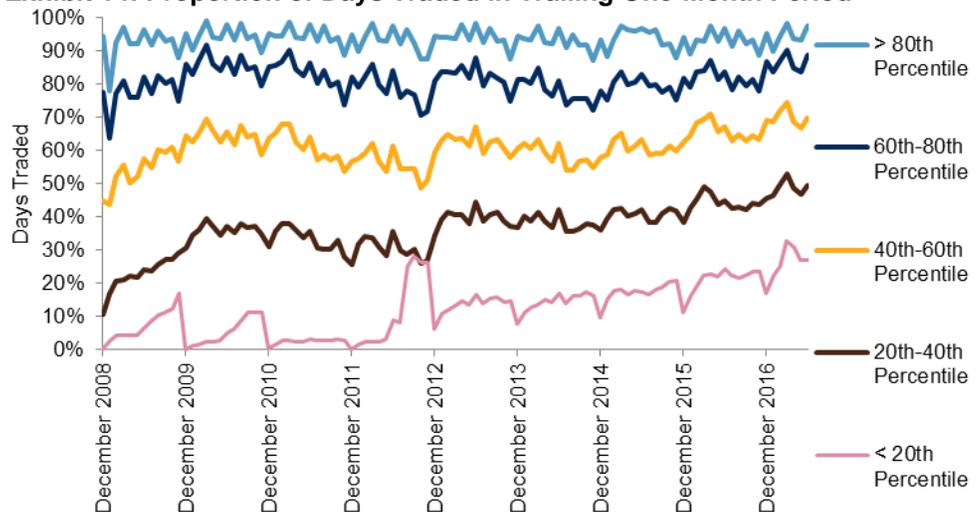


Bonds that traded in relatively larger volume and with a higher frequency at one point in time tended to trade in relatively larger volume and with a higher frequency in the future.

Source: S&P Dow Jones Indices LLC, FINRA. Data as of June 30, 2017. Past performance is no guarantee of future results. Chart is provided for illustrative purposes.

Bonds that traded in relatively larger volume and with a higher frequency at one point in time tended to trade in relatively larger volume and with a higher frequency in the future. The coincidence of bond characteristics such as size and age with trade volume and frequency suggests that the liquidity of a bond can persist over time. Exhibit 14 shows that bonds that score in the top percentile in terms of frequency of trades continue to do so. The partitions are rebalanced annually. That is to say, the bonds that traded at high frequency in December 2016 continued to trade nearly every day through June 2017.

**Exhibit 14: Proportion of Days Traded in Trailing One-Month Period**

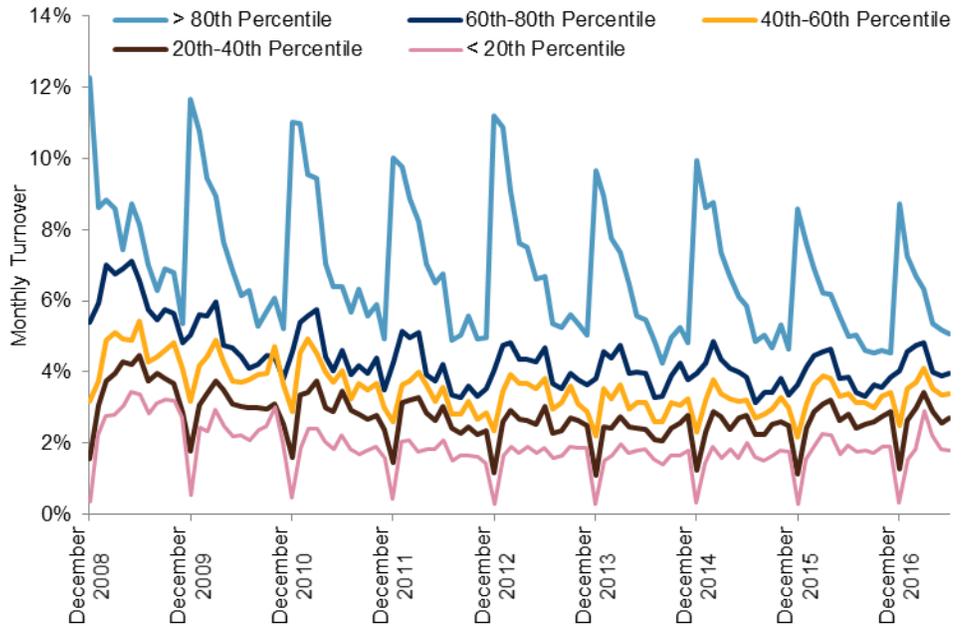


Source: S&P Dow Jones Indices LLC, FINRA. Data as of June 30, 2017. Past performance is no guarantee of future results. Chart is provided for illustrative purposes.

Bonds that traded in high volume also tended to continue to trade in high volume. Exhibit 15 shows that although turnover rates can drop over time, the relative order is preserved. Exhibit 16 shows the persistence of a single group of stocks over a two-month period. The pattern is similar regardless of observation date.

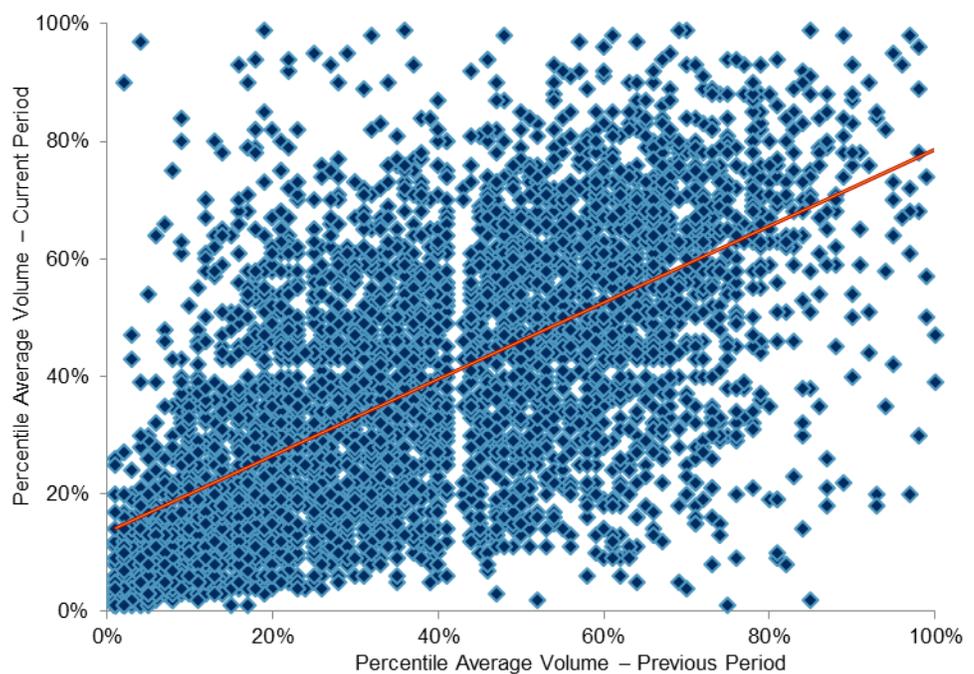
Bonds that traded in high volume also tended to continue to trade in high volume.

**Exhibit 15: Monthly Turnover by Annual Liquidity Partition**



Source: S&P Dow Jones Indices LLC, FINRA. Data as of June 30, 2017. Past performance is no guarantee of future results. Chart is provided for illustrative purposes.

**Exhibit 16: Percentile Rank: Current Month Versus Previous Month**



Source: S&P Dow Jones Indices LLC, FINRA. Data as of June 30, 2017. Past performance is no guarantee of future results. Chart is provided for illustrative purposes.

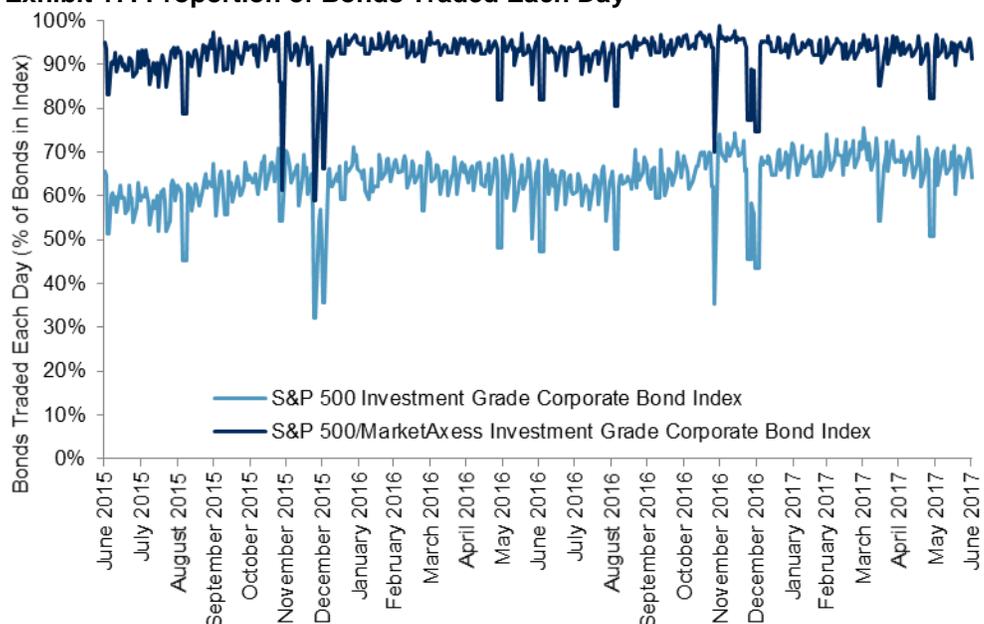
### Construction of a Replicable, Liquid Index

In addition to using size and age of bonds as proxies to measure liquidity, the persistence of relative liquidity rank over time suggests that we can incorporate signals based on trailing TRACE data in selecting for liquid bonds. Against that theoretical underpinning, we constructed the [S&P 500/MarketAxess Investment Grade Corporate Bond Index](#) as a narrower, replicable, and investable subindex of the [S&P 500 Investment Grade Corporate Bond Index](#) by layering on additional liquidity rules. Key restricting factors include a higher minimum par requirement (USD 750 million versus USD 250 million) and a constituent count (top 1,000) based on ranking determined by volume data. The subindex tracks its benchmark while selecting from bonds that have traded more frequently.

The methodology produces a subindex with improved relative liquidity vis-a-vis the benchmark S&P 500 Investment Grade Corporate Bond Index. Considering daily activity over the past two years, we found that, on average, 93% of the S&P 500/MarketAxess Investment Grade Corporate Bond Index constituents trade each day (see Exhibit 17) versus 64% of the S&P 500 Investment Grade Corporate Bond Index. Exhibit 18 shows the trend in volume as a percentage of amount outstanding (turnover rate). As of June 2017, it would take about 23 months (at 4.30% per month) to turn over the entire USD 3.8 trillion in the S&P 500 Investment Grade Corporate Bond Index, while it would take five fewer months (at 5.6% per month) to turn over the USD 1.63 trillion that makes up the S&P 500/MarketAxess Investment Grade Corporate Bond Index.

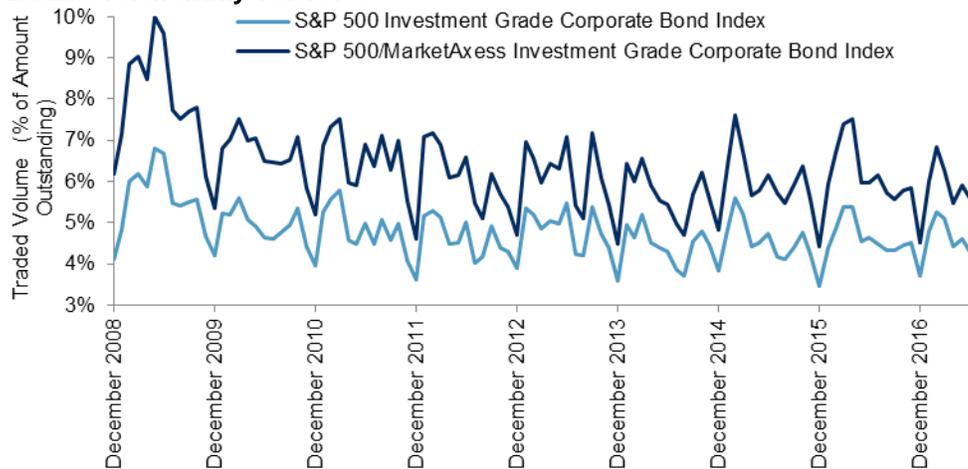
The methodology produces a subindex with improved relative liquidity vis-a-vis the benchmark S&P 500 Investment Grade Corporate Bond Index.

**Exhibit 17: Proportion of Bonds Traded Each Day**



Source: S&P Dow Jones Indices LLC, FINRA. Data as of June 30, 2017. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

**Exhibit 18: Monthly Turnover**

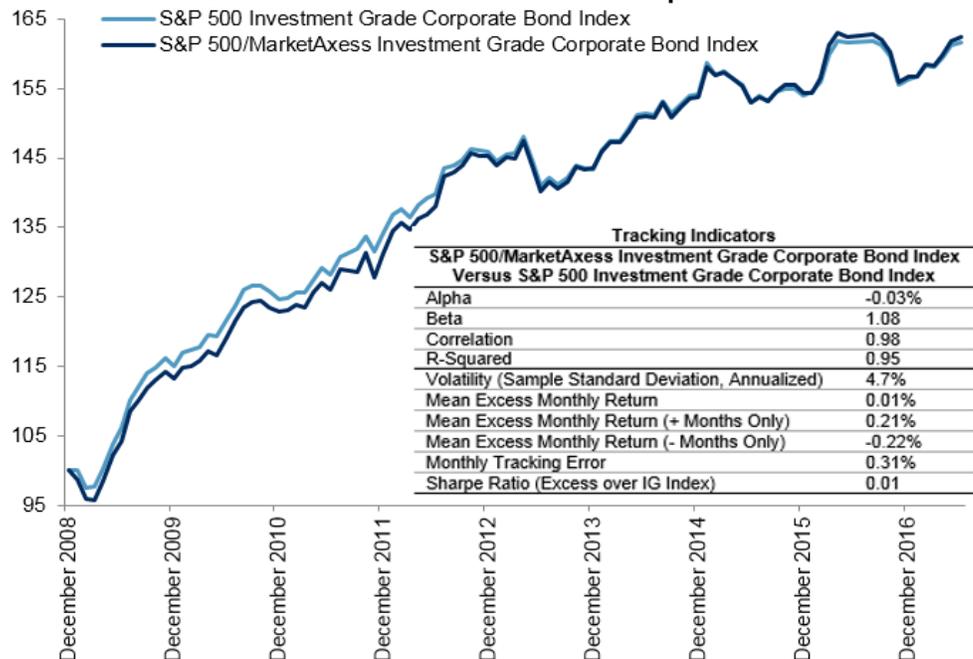


The S&P 500/MarketAxess Investment Grade Corporate Bond Index closely tracks the S&P 500 Investment Grade Corporate Bond Index in performance.

Source: S&P Dow Jones Indices LLC, FINRA. Data as of June 30, 2017. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

The [S&P 500/MarketAxess Investment Grade Corporate Bond Index](#) closely tracks the [S&P 500 Investment Grade Corporate Bond Index](#) in performance. This is despite the lack of rules requiring the subindex to match key risk characteristics, such as credit rating, industry sector, duration, convexity, and yield-to-maturity of the benchmark index. Monthly returns have a correlation of 98% over the available nine-year history.

**Exhibit 19: Total Return S&P 500 Investment Grade Corporate Bond Index Versus S&P 500/MarketAxess Investment Grade Corporate Bond Index**



Source: S&P Dow Jones Indices LLC, FINRA. Data from December 2008 to June 2017. Past performance is no guarantee of future results. Chart is provided for illustrative purposes and reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

## CONCLUSION

Our analysis shows that, all else being equal, bonds that are larger in size and younger in age tend to have a higher frequency of trading and higher turnover volume, and therefore they are more liquid.

In this paper, we examined simple measures such as frequency of trading and turnover to assess the relative liquidity of a bond. We further tested to see if bond characteristics such as age and size could result in meaningful differences in a bond's liquidity profile. Our analysis shows that, all else being equal, bonds that are larger in size and younger in age tend to have a higher frequency of trading and higher turnover, and therefore they are more liquid. The findings serve as the underlying basis to construct a narrower, replicable subindex, the [S&P 500/MarketAxess Investment Grade Corporate Bond Index](#), to focus on a broad-based, investment-grade corporate bond universe issued by [S&P 500](#) companies.

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## PERFORMANCE DISCLOSURE

The S&P 500 Bond Index was launched on July 8, 2015. The S&P 500 Investment Grade Corporate Bond Index was launched on July 8, 2015. The S&P 500/MarketAxess Investment Grade Corporate Bond Index was launched on January 9, 2017. All information presented prior to an index's Launch Date is hypothetical (back-tested), not actual performance. The back-test calculations are based on the same methodology that was in effect on the index Launch Date. Complete index methodology details are available at [www.spdji.com](http://www.spdji.com).

S&P Dow Jones Indices defines various dates to assist our clients in providing transparency. The First Value Date is the first day for which there is a calculated value (either live or back-tested) for a given index. The Base Date is the date at which the Index is set at a fixed value for calculation purposes. The Launch Date designates the date upon which the values of an index are first considered live: index values provided for any date or time period prior to the index's Launch Date are considered back-tested. S&P Dow Jones Indices defines the Launch Date as the date by which the values of an index are known to have been released to the public, for example via the company's public website or its datafeed to external parties. For Dow Jones-branded indices introduced prior to May 31, 2013, the Launch Date (which prior to May 31, 2013, was termed "Date of introduction") is set at a date upon which no further changes were permitted to be made to the index methodology, but that may have been prior to the Index's public release date.

Past performance of the Index is not an indication of future results. Prospective application of the methodology used to construct the Index may not result in performance commensurate with the back-test returns shown. The back-test period does not necessarily correspond to the entire available history of the Index. Please refer to the methodology paper for the Index, available at [www.spdji.com](http://www.spdji.com) for more details about the index, including the manner in which it is rebalanced, the timing of such rebalancing, criteria for additions and deletions, as well as all index calculations.

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