ETF Options Watch

Mapping the Fixed Income ETF ecosystem

Bank of America Merrill Lynch

Primer

06 December 2019

Fixed income ETFs and ETF options are growing rapidly

Following two decades of dramatic growth, we estimate US ETF fixed income (FI) assets under management (AUM) now exceed 20% of total ETF assets, an ~$820bn pool of capital. Investor interest in FI ETFs and ETF options has also led to a dramatic increase in liquidity in recent years, bringing transparency to the somewhat opaque FI market. As ETFs are continuously issued securities, liquidity originates both in the primary and secondary markets. The net asset value (NAV) of an ETF will often vary from its secondary traded value, triggering arbitrage opportunities. In this note, we map the FI ETF ecosystem and plumb the depths of price formation.

Introducing a practical guide to the FI ETFs ecosystem

Role of liquidity providers: The creation/redemption (CR) mechanism provides a strong economic incentive for the provision of primary liquidity in the ETF markets through Authorized Participants (AP). The number of registered APs varies quite a lot. For instance, based on SEC filings, HYG has 48 APs. But not all of them are active. SPY has less than half as many APs as HYG, but nearly 3x as many active APs (22). APs are not the only official liquidity providers (OLPs). Others include market makers, hedge funds, and proprietary trading firms. ETFs have an average of 17 OLPs.

Primary vs. secondary activity in FI ETFs is small as a % of secondary, but it increases in times of stress and plays a key role in price formation. On most days of the year, the vast majority of ETFs do not have any primary activity, and FI ETFs see CR activity less than 20% of the year. However, the larger the AUM of an ETF, the more often generally it tends to have primary activity. More importantly, daily CR constitute a greater proportion (18%) of total trading for bond ETFs than for equity (10%) and commodity (9%) ETFs.

Deviations from NAV: The CR arbitrage mechanism should ensure that ETFs trade very close to their NAV. However, ETFs with relatively illiquid or perhaps an international underlying in the fixed income markets have larger arbitrage boundaries, and deviations from NAV (e.g., on avg. HYG traded at a 20bps premium over the past 2yrs). Deviations widen in times of market stress, with HYG discount to NAV going as low as 90bps in the midst of the 4Q18 sell-off.

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Timestamp: 06 December 2019 11:43AM EST

Putting the growth of FI ETFs into context

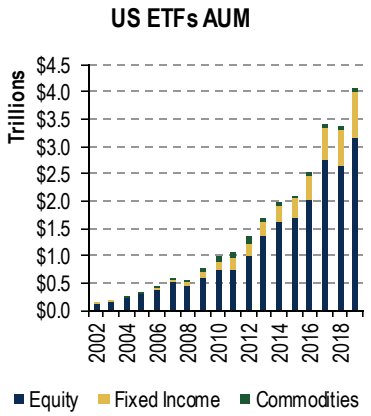
Key finding: AUM in US Fixed Income ETFs is now 1/5th of the total AUM in Equity+ Fixed Income+ Commodities ETFs, the largest share since 2002

Assets in US ETFs, and in particular in Fixed Income (FI) ETFs, have seen rapid growth in recent years. This has raised some important concerns among investors and regulators, to the point that the Fixed Income Market Structure Advisory Committee (FIMSAC), for instance, tasked the subcommittee on ETFs and Bond Funds with studying the implications of this growth, and in particular on liquidity and pricing in corporate bond markets.

For instance, according to the Securities Industry and Financial Markets Association (SIFMA), as of Q1 2019, the U.S. bond market size was ~$43 trillion. This means that at $819 billion, US FI ETFs now constitute ~2% of the total US bond market, a 92-fold increase from 0.02% at the end of 2002, when such funds were first introduced (see Charts 1 and 2).

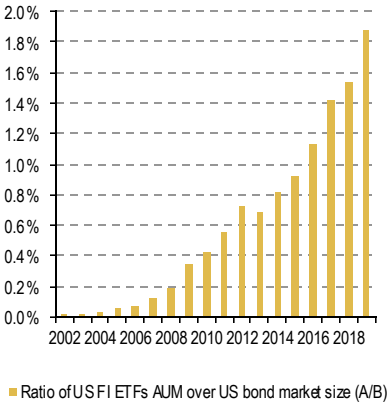
The share of US FI ETFs vs. US Equity and Commodity ETFs is also rising (see Chart 3), as US FI ETF AUM is now one-fifth of the total AUM in Equity + Fixed Income + Commodities ETFs, the largest share since 2002.

Chart 1: AUM in US ETFs has grown exponentially since they were first launched in 2002, without showing signs of abatement



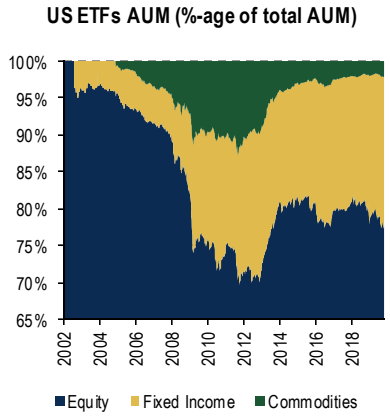
Source: BofA Merrill Lynch Global Research

Chart 2: US FI ETFs now constitute ~2% of the total US bond market, a 92 fold increase from 0.02% at the end of 2002



Source: BofA Merrill Lynch Global Research, Securities Industry and Financial Markets Association (SIFMA)

Chart 3: The share of Fixed Income AUM vs. Equity + Commodity is now the largest since 2002



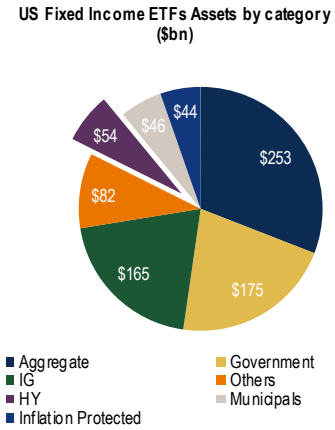
Source: BofA Merrill Lynch Global Research

Drilling down further, FI ETFs have experienced growth in a variety of sub-asset classes of the bond market in recent years. Initially, these were typically portfolios of investment grade and government bonds but have been extended to other categories, including high-yield bonds. For instance, total AUM of US HY bond ETFs now amounts to $54bn, 6.6% of the total AUM of US FI ETFs (see Chart 4).

Within the HY segment, it is interesting to note that the %-age share of AUM commanded by HYG and JNK (the very first HY ETFs launched in 2007) has now shrunk to 54% from 73% only four years ago (see Chart 5).

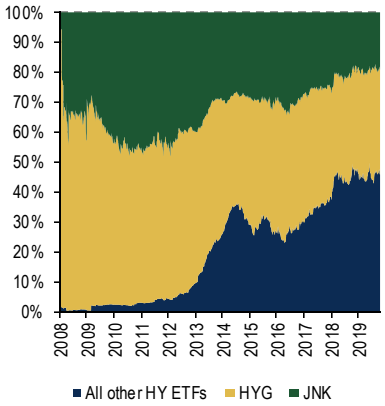
This is likely due to increased competition in terms of the number of ETFs (of today's 59 US HY ETFs, less than half existed four years ago) and fund expense ratios (at 40bps and 49bps, the expense ratios of JNK and HYG rank 26th and 46th lowest, respectively, among the existing 59 US HY ETFs) (see Chart 6).

Chart 4: Within FI ETFs in the US, HY ETFs now represents a relatively large share, in spite of their later launch



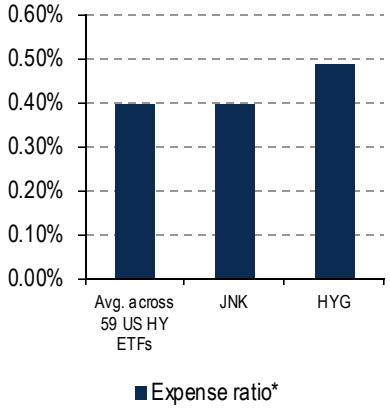
Source: BofA Merrill Lynch Global Research

Chart 5: While HYG and JNK continue to command the largest share among HY ETFs, their relative weight has diminished...



Source: BofA Merrill Lynch Global Research

Chart 6: ... likely due to increased competition in terms of the number of ETFs and fund expense ratios

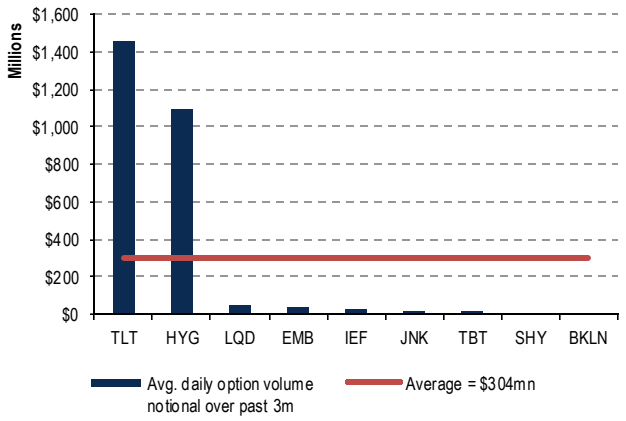


Source: BofA Merrill Lynch Global Research. Data as of 21-Oct-19.

FI ETFs option markets remain strongly concentrated

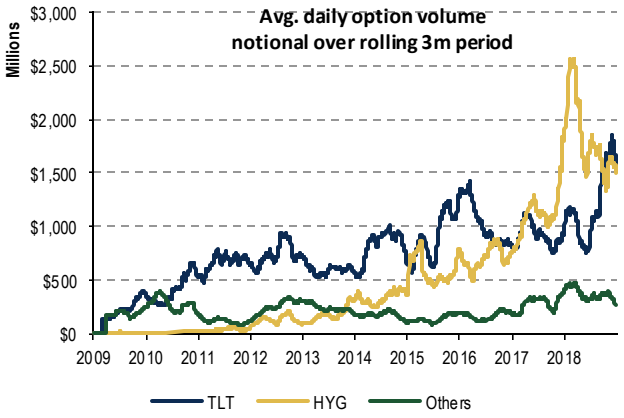
Less than one fifth (19%) of the 419 US FI ETFs have listed options markets. Of these ETFs, the average daily option volume notional over the past quarter was $183k, excluding the top 10 ETFs by volume notional. For reference, as a rule of thumb, the average daily option volume notional for a liquid option market is at least $5mn. Indeed, among the 9 ETFs that satisfy this liquidity criteria, TLT and HYG take the lion's share (see Chart 7), with an average daily option volume notional over the past quarter of $1.4bn and $1.1bn, respectively, vs. a combined volume notional of $183mn for all the other 7 ETFs. Looking at the past 10 years, this discrepancy between TLT+HYG option volume notional vs. the other ETFs has only increased and accelerated since 2015, suggesting options activity remains strongly concentrated (see Chart 8). Importantly, options activity tends to track volume in the underlying instrument. As such, as more FI ETFs become popular, we would expect this divergence to possibly slow down or perhaps even reverse.

Chart 7: TLT and HYG take the lion's share of the options trading activity among FI ETFs



Source: BofA Merrill Lynch Global Research

Chart 8: The discrepancy between TLT+HYG option volume notional vs. the other FI ETFs* has only increased and accelerated since 2015, suggesting options activity remains strongly concentrated



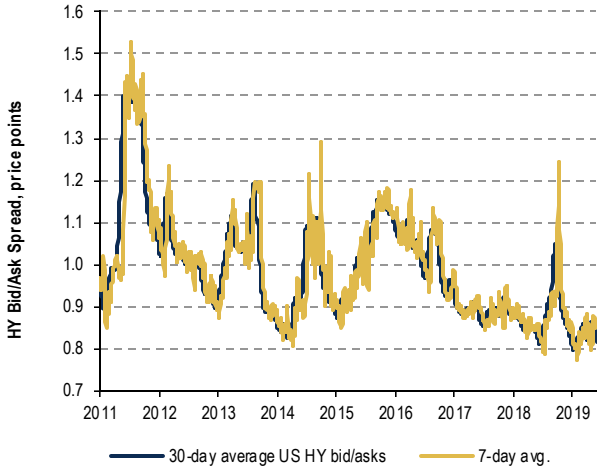
Source: BofA Merrill Lynch Global Research. *We only consider FI ETFs where the average daily option volume notional is at least $5mn.

What is behind the rising popularity of HYG?

Key finding: Among the most relevant factors explaining the rise in HYG's popularity are: transparency, lower costs & diversification, for retail; and liquidity enhancement (in the context of a regulatory-induced decrease in bond liquidity) & HY issuance explosion in the post-GFC era, for institutions

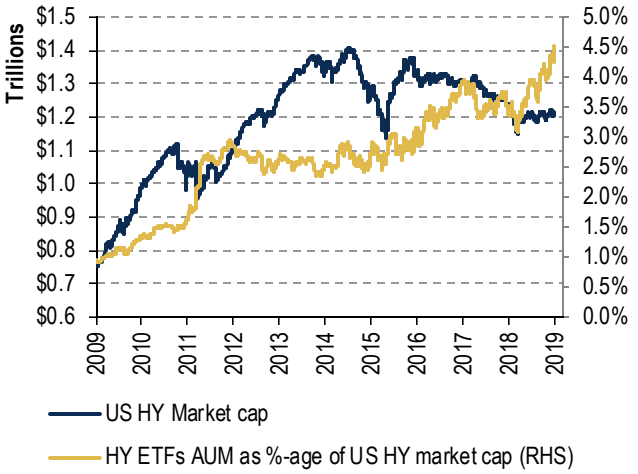
- **Transparency**: Many individual corporate bonds trade primarily in the opaque, dealer ("over-the-counter" or OTC) market characterized by a lack of accessible pre- and post-trade transparency, lack of liquidity, and infrequent trading. In contrast, FI ETFs trade intraday on electronic exchanges ("lit" markets) that offer a high degree of transparency, meaning that actionable bid and offer quotes are readily available.
- **Lower costs**: Many fixed income ETFs have low bid-ask spreads compared to the underlying bonds. This is definitely the case with HYG. For instance, the weekly average HY bid/ask is 0.79 (price points) (see Chart 9), vs. 0.01 for HYG.
- **Diversification**: In the context of portfolio construction, FI ETFs provide a way to obtain instant diversification in a single trade. For instance, consider that the Markit iBoxx USD Liquid High Yield Index (the index that HYG seeks to track) included approximately 946 constituents as of February 28, 2019.

Chart 9: Bid-ask spreads on HY cash bonds are typically much higher vs. HYG (0.79 vs. 0.01, on average)



Source: BofA Merrill Lynch Global Research

Chart 10: In spite of the growing popularity of HY ETFs, they still remain a small fraction of the overall HY market cap…

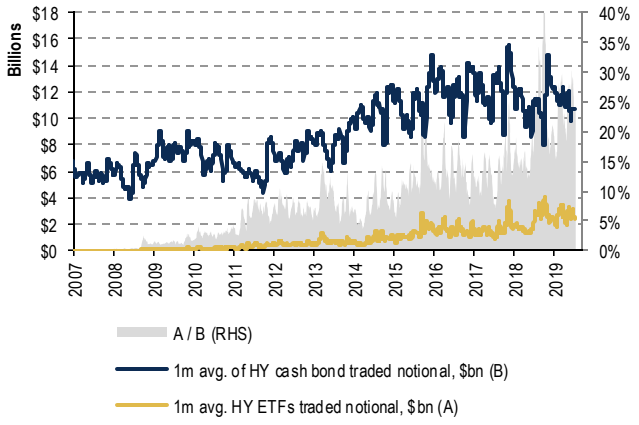


Source: BofA Merrill Lynch Global Research

- **Liquidity sleeves:** As we outlined in the past, HYG's tight spreads and deep liquidity have drawn big institutions that use it like a "hotel", or as a temporary placeholder to park cash while ramping up bond portfolio inflows or to make tactical adjustments (e.g., shortening duration ahead of an expected uptick in interest rates). Notably, the liquidity growth in HY ETFs has significantly outstripped asset growth. For instance, while at $54 billion the combined AUM of all the US HY ETFs makes up only 4.5% of the HY cash bond market (see Chart 10), the combined notional trading volume of all HY ETFs is 23% as large as HY cash bond trading volume (see Chart 11). The rapid growth in HY ETF trading volume vs. fund assets implies there is a sizable population of frequent traders and is congruous with the aforementioned idea that HY ETFs are increasingly being used as liquidity enhancement tools.

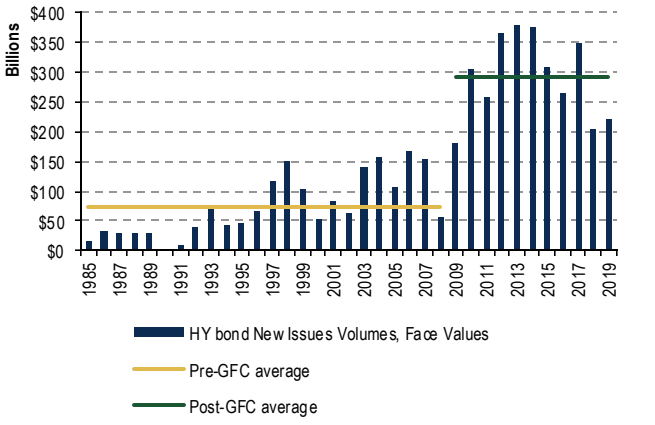
- **Explosion in HY issuance post-GFC:** The explosion in HY bond issuance in the post-GFC years is another likely reason behind the growth in popularity of HYG, as the ETF provides easy access to the booming HY bond market (post-crisis average yearly HY bond issuance is 4x as large as in pre-crisis years) (see Chart 12).

Chart 11: ...However, trading volume in HY ETFs is significant vs. the HY market, in line with the idea that ETFs are used as liquidity sleeves



Source: BofA Merrill Lynch Global Research

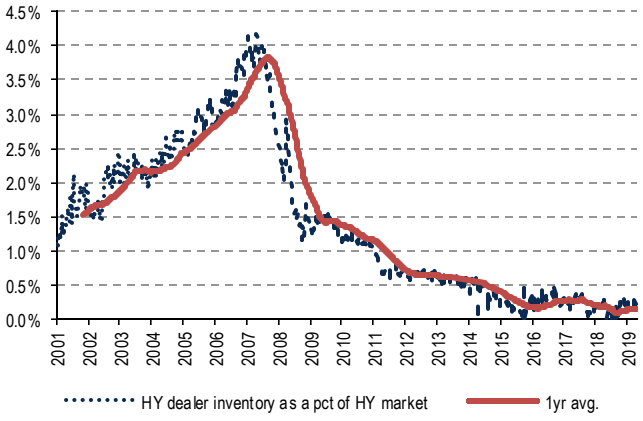
Chart 12: The surge in HYG popularity occurred also in response to booming HY bond issuance post-GFC



Source: BofA Merrill Lynch Global Research

- **Regulation-induced reduction in bond market liquidity**: Using HYG as a liquidity sleeve has become increasingly important given the reduced liquidity in bond markets post-crisis. Specifically, after the financial crisis, stricter regulations have forced many fixed income dealers and other liquidity providers to reduce their traditional role as markets makers as they slashed inventories and cut back on the amount of capital devoted to providing liquidity. For instance, Chart 13 shows that at its peak, HY dealer inventory accounted for as much as 4% of the total HY market pre-crisis, while it's now less than a quarter of a percentage point.

Chart 13: HY dealer inventories plummeted post GFC as stricter regulations forced dealers to reduce their market making activity



Source: BofA Merrill Lynch Global Research

A practical guide to the FI ETFs ecosystem

ETFs can be accessed in two markets: the primary market, via creation and redemption orders (CRs) through Authorized Participant (APs), and the secondary market, on exchanges that list ETFs (NYSE ARCA is the primary exchange for HYG), and in other venues via trading with other investors through market makers or liquidity providers. An investor with a large ETF trade (relative to the average daily trading volume of the ETF) will tend to use an authorized participant (AP) to create and redeem ETF shares in order to minimize disruption and price impact in the secondary market for the ETF.

Do investors primarily use the CR mechanism available via an AP or do they prefer to trade with another investor in the secondary market? Answering this question is crucial in the context of establishing a potential link between the arbitrage mechanism used by APs and other ETF investors, and volatility in the underlying securities held by an ETF.

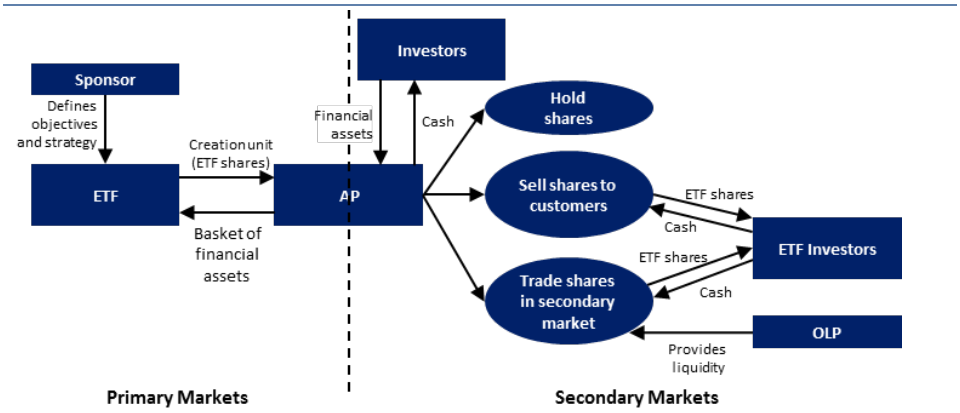
Indeed, in the first case, CR generates trading in the underlying securities (which in the case of HYG are generally less liquid bonds). In the latter case, only ETF shares trade hands. The first case is particularly relevant in the context of the "liquidity mismatch" problem (i.e., a liquidity mismatch emerges when liquid exchange traded funds (ETFs) hold relatively illiquid assets), which could increase the fragility of an ETF.

Some investors worry that this mismatch in liquidity essentially can cause a liquidity trap in times of stress, and as such, it poses a systemic risk. However, before delving into the specifics of this liquidity issue, and in the interest of bringing every reader on the same page, below we shed some light on aspects of the HYG ecosystem and the CR mechanism that we believe are crucially relevant to fully appreciate the complexity and realness behind regulators' concerns.

Q&A session on FI ETFs ecosystem and CR arbitrage mechanisms

The creation/redemption mechanism in the ETF structure allows the number of shares outstanding in an ETF to expand or contract based on demand. When ETF shares are created or redeemed, this is categorized as primary market activity. ETF shares are created when an AP, typically a large financial institution, submits an order for one or more "creation units" (the creation unit for HYG is 100,000).

The ETF shares are delivered to the AP when the specified creation basket is transferred to the ETF sponsor. The redemption process is simply the reverse. A creation unit is redeemed when an AP acquires (through purchases or exchanges, principal transactions, or private transactions) the number of shares specified in the ETF's creation unit and returns the creation unit to the ETF. Below is a graphic representation of the ETF ecosystem.

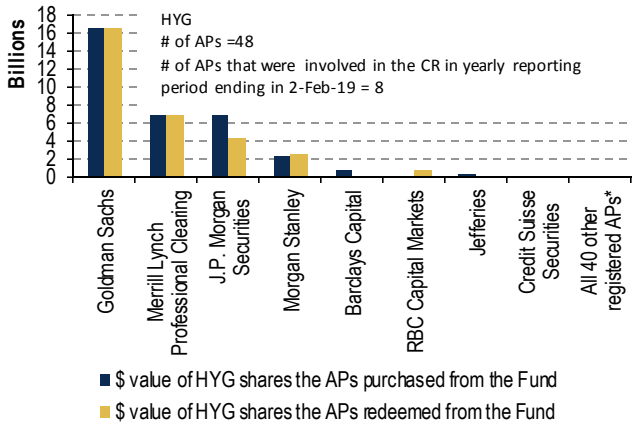


What is an Authorized Participant (AP)?

An AP is typically a large financial institution that enters into a legal contract with an ETF distributor to create and redeem shares of the fund. APs are the only investors allowed to interact directly with the fund. They do not receive compensation from an ETF or its sponsor and have no legal obligation to create or redeem the ETF's shares. APs typically derive their compensation from acting as dealers, but some APs act as agents for a wide array of market participants, such as registered investment advisers and various liquidity providers (official liquidity provider = OLP), including market makers, hedge funds, and proprietary trading firms.

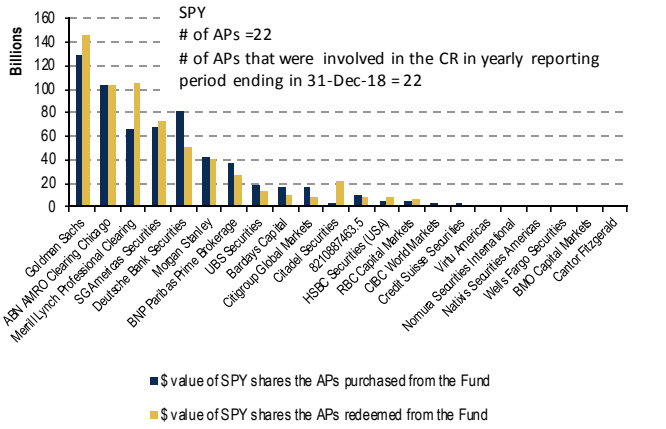
Based on SEC filings (Form N-CEN), in the year ending 2-Feb-19, the top 3 APs for HYG were Goldman Sachs, Merrill Lynch Professional Clearing, and J.P. Morgan Securities (see Chart 14 and 15).

Chart 14: There is an important distinction between registered and active APs. For instance, HYG has more than twice as many registered APs as SPY...



Source: BofA Merrill Lynch Global Research. SEC filings (Form N-CEN), in the year ending 2-Feb-19. *ABN AMRO Clearing Chicago, ABN AMRO Securities (USA), Banca IMI Securities, BMO Capital Markets, BNP Paribas Prime Brokerage, BNP Paribas Securities, BNY Mellon Capital Markets, Cantor Fitzgerald, CIBC World Markets, Citadel Securities, Citigroup Global Markets, Cowen Execution Services, Daiwa Capital Markets America, Deutsche Bank Securities, HRT Financial, HSBC Securities (USA), Industrial and Commercial Bank of China Fin. Sv., ING Financial Markets, Itau BBA USA Securities, ITG, Jane Street Capital, Merrill Lynch, Pierce, Fenner & Smith, Mizuho Securities, MUFG Securities Americas, National Bank Of Canada Financial, Natixis Securities Americas, Natwest Markets Securities, Nomura Securities International, Pershing, Scotia Capital (USA), SG Americas Securities, State Street Global Advisors Funds Distributors, State Street Global Markets, Stifel Nicolaus, Timber Hill, UBS Securities, Virtu Americas, Virtu Financial BD, Wedbush Securities, Wells Fargo Securities.

Chart 15: ...but only about a third as many active APs

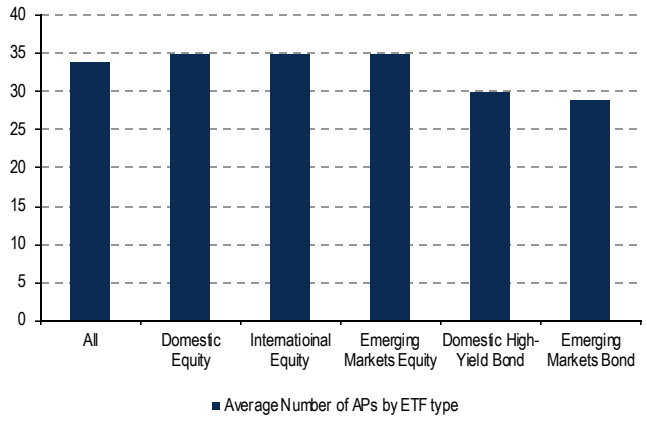


Source: BofA Merrill Lynch Global Research. SEC filings (Form N-CEN), in the year ending 31-Dec-18 = 22.

How many APs are there?

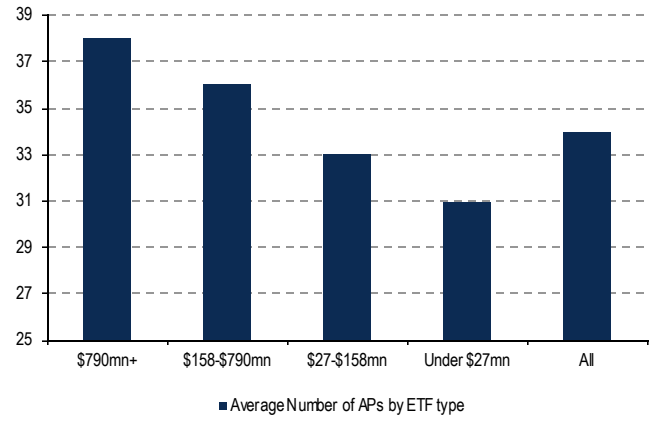
In March 2015, the Investment Company Institute (ICI) conducted a brief survey of its members that sponsor exchange-traded funds (ETFs). The survey shows that on average, each ETF in the sample has 34 AP agreements. ETFs with more assets under management have more AP agreements in place than ETFs with fewer assets under management. The average number of AP agreements for bond ETFs was lower than the number for equity ETFs (35 on average for equity vs. 30 for domestic HY bonds, for instance, as of the time of the survey) (see Charts 16 and 17). Based on SEC filings (Form N-CEN), in the year ending 2-Feb-19, HYG had 48 APs (see Chart 14).

Chart 16: The average number of AP agreements for bond ETFs was lower than the number for equity ETFs...



Source: BofA Merrill Lynch Global Research, ICI

Chart 17: ...in line with the fact that ETFs with more assets under management have more AP agreements in place than ETFs with fewer assets under management



Source: BofA Merrill Lynch Global Research, ICI

How many APs are actively creating and redeeming ETF shares?

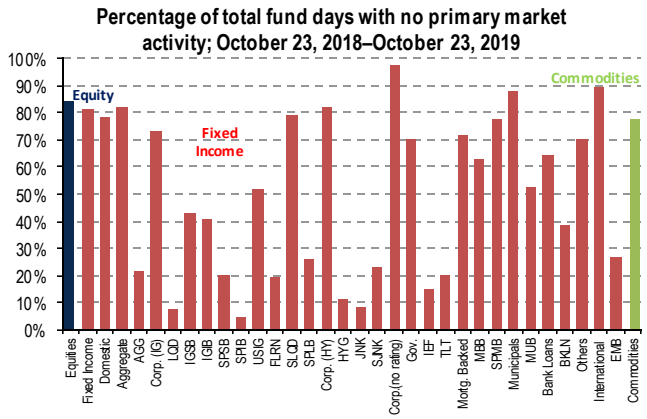
Not all registered APs are actively involved in the creation/redemption of ETF shares (for the purposes of the ICI survey, an AP was deemed active in an ETF if it had conducted at least one creation or redemption in that particular ETF's shares in the previous six months). For instance, emerging markets bond ETFs have only an average of 3 active APs, as the ability to conduct transactions in foreign securities is more challenging than for domestic securities. Indeed, some foreign markets require investors to have foreign investor status, a local bank account, a local custodian, and pre-collateralization of trades to access their markets.

Based on SEC filings (Form N-CEN), in the year ending 2-Feb-19, HYG had 8 APs that had actually created/redeemed HYG shares. Charts 14 and 15 also show how important the distinction is between registered and active APs. For instance, SPY has less than half as many APs as HYG but 3x as many active APs.

How often do APs create and redeem ETF shares?

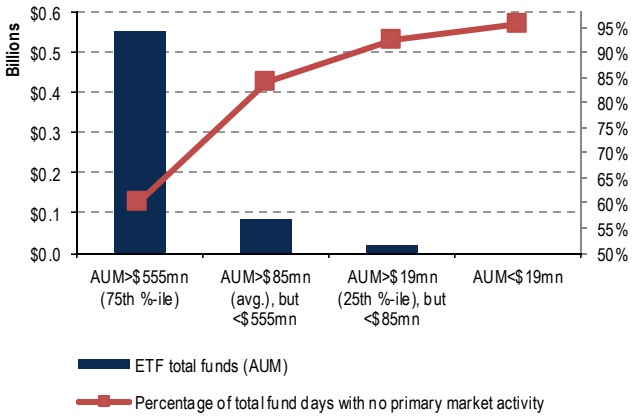
APs create and redeem ETF shares in response to supply and demand and the inventory management needs of secondary market participants. On most trading days, the vast majority of ETFs do not have any primary market activity—that is, they do not create or redeem shares (see Chart 18). In addition, Chart 19 shows that the larger the AUM of an ETF, the more often it has primary activity. Indeed, four of the top 5 largest ETFs by AUM (SPY, IVV, VTI, VOO, and QQQ) had no primary market activity less than 4 days over the past year. Although larger ETFs have creations and redemptions more often, these ETFs, as noted above, also have more APs that are active.

Chart 18: On most days, the vast majority of ETFs do not have any primary market activity—that is, no creation or redemption of shares



Source: BofA Merrill Lynch Global Research

Chart 19: The larger the AUM of an ETF, the more often it ends to have primary market activity



Source: BofA Merrill Lynch Global Research

How big is the primary market vs. secondary?

The table below examines data on the relative size of primary market activity (creation and redemption) and secondary market trading in ETFs by broad investment objective. Importantly, we include averages over the past year, as well as during 4Q-18, a period characterized by high volatility.

Table 1: Summary of Primary Market Activity and Secondary Market Trading Across ETFs

				Primary Market†				Secondary market			
	*Number of ETFs***	*Total Net Assets ($bn)*		*Avg. daily creations/redemptions ($mn)*		*Primary market relative to total net assets (%-age)‡*		*Avg. daily volume ($mn)*		*Primary market vs. total trading (%-age)◊*	
Investment Objective		**End of Q4-18**	**Current****	**Q4-18**	**Past year**	**Q4-18**	**Past year**	**Q4-18**	**Past year**	**Q4-18**	**Past year**
Equities	1640	$2,653	$3,183	$10,349	$8,796	0.39	0.28	$114,547	$82,073	8.3	9.7
Fixed Income	417	$659	$821	$2,560	$2,489	0.39	0.30	$11,809	$11,579	17.8	17.7
Domestic	319	$585	$724	$2,336	$2,243	0.40	0.31	$10,783	$10,496	17.8	17.6
Aggregate	53	$167	$190	$326	$323	0.20	0.17	$1,409	$1,296	18.8	19.9
AGG	--	$57	$66	$118	$61	0.21	0.09	$611	$508	16.2	10.8
Corporate (IG)	58	$129	$163	$347	$417	0.27	0.25	$1,831	$2,014	15.9	17.1
LQD	--	$30	$35	$129	$138	0.43	0.39	$1,044	$1,188	11.0	10.4
IGSB	--	$10	$13	$7	$19	0.06	0.14	$59	$71	10.0	21.0
IGIB	--	$5	$9	$9	$16	0.18	0.18	$34	$46	21.3	25.4
SPSB	--	$5	$6	$18	$18	0.38	0.28	$38	$42	31.4	29.5
SPIB	--	$4	$5	$22	$25	0.54	0.48	$39	$42	35.5	37.1
USIG	--	$2	$4	$3	$13	0.14	0.34	$13	$27	19.9	33.2
FLRN	--	$4	$4	$22	$14	0.52	0.38	$64	$44	25.6	24.3
SLQD	--	$1	$2	$2	$2	0.16	0.12	$9	$8	21.3	22.3
SPLB	--	$0.4	$1	$3	$6	0.84	0.95	$5	$9	37.2	38.7
Corporate (HY)	44	$36	$53	$550	$433	1.54	0.82	$2,980	$2,739	15.6	13.7
HYG	--	$13	$19	$284	$208	2.15	1.10	$2,076	$1,847	12.0	10.1
JNK	--	$7	$10	$159	$132	2.35	1.26	$618	$644	20.4	17.0
SJNK	--	$2	$3	$29	$21	1.17	0.64	$76	$69	27.5	23.3
Corporate (no rating)*	10	$0	$0.3	$0	$5	0.07	1.51	$2	$1	7.0	87.6
Government	53	$115	$146	$735	$751	0.64	0.51	$3,016	$3,240	19.6	18.8
IEF	--	$10	$19	$64	$115	0.63	0.62	$453	$527	12.4	18.0
TLT	--	$9	$18	$122	$128	1.40	0.70	$1,157	$1,272	9.6	9.2
Mortgage-Backed	8	$23	$35	$38	$66	0.17	0.19	$154	$193	19.9	25.4
MBB	--	$12	$19	$22	$38	0.18	0.20	$96	$122	18.6	23.8
SPMB	--	$0.2	$1	$1	$3	0.34	0.41	$2	$4	29.4	41.7
Municipals	58	$37	$46	$94	$70	0.26	0.15	$431	$284	17.9	19.7
MUB	--	$12	$14	$39	$27	0.33	0.19	$157	$109	20.1	20.1
Bank Loans	5	$10	$9	$78	$55	0.82	0.62	$304	$210	20.5	20.7
BKLN	--	$5	$5	$49	$32	0.90	0.67	$224	$159	17.9	16.9
Others	30	$70	$81	$168	$125	0.24	0.15	$657	$518	20.4	19.5
International	98	$74	$97	$224	$246	0.30	0.25	$1,026	$1,083	17.9	18.5
EMB	--	$14	$14	$44	$63	0.31	0.44	$423	$484	9.4	11.5
Commodities	151	$67	$87	$260	$286	0.39	0.33	$3,094	$3,023	7.8	8.6

Source: BofA Merrill Lynch Global Research. *No rating focus specified in the prospectus. **23-Oct-19. † Daily creations or redemptions for each ETF are estimated by multiplying the daily change in shares outstanding by the daily NAV from Bloomberg. Aggregate daily creations and redemptions are computed by adding creations and the absolute value of redemptions across all ETFs in each investment objective each day. Average is taken across the sampled period. ‡ Ratio of avg. daily creations and redemptions to total net assets. ◊ Ratio of avg. daily creations and redemptions to the sum of avg. daily creations and redemptions and avg. daily volume.

We rely on two popular measures to determine the relative size of primary market activity: i) CR vs. the fund's Total Assets (Total amount of money invested in the fund, including cash and securities), and ii) CR vs. trading volume in the ETF secondary market.

Secondary market activity is a gross measure (does not net out buying/selling orders). On the other hand, CR activity, as measured by multiplying the daily change in shares outstanding by the daily NAV (as per calculation in the table above), is a net figure. As such, the two measures should theoretically not be directly comparable. Notably, gross CR activity on a daily basis is not publicly available.

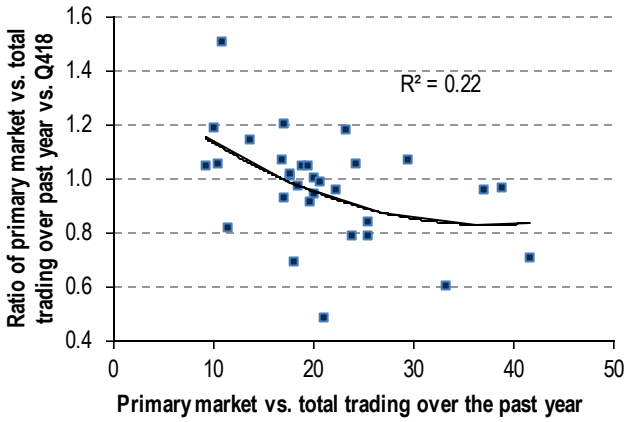
However, in practice the net CR activity is extremely close to the gross figure, since primary market activity, like mutual funds, is aggregated and executed just once per day at NAV. Cutoff times for CR orders generally vary by asset class. Domestic fixed-income ETFs, which predominantly have optimized baskets—a combination of cash and securities—can have deadlines that are 30 to 90 minutes prior to the close of the bond markets.

Comparing CR activity to Total Assets is relevant with respect to the notion of a negative feedback loop in the context of market stress and massive redemption orders, where volatility drives net outflows that in turn cause ETF portfolio managers to sell assets to meet redemptions, further accentuating a decline in the overall markets. Below are a few observations from Table 1:

- There is high variation among FI ETFs in terms of how large CR activity is as a %-age of total trading volume, ranging from ~10% for ETFs like HYG, LQD, IEF and TLT, to >25% for ETFs like IGIB, SPSB, SPIB. ETF segments/ETFs where the CR activity represents a larger %-age of trading volume did not see a relative increase in CR activity during Q4-18 (quite the opposite, but the relationship is not statistically strong) (see Chart 20). Indeed, the reduction in CR activity for these ETF segments/ ETFs was more than commensurate with the reduction in trading volume.

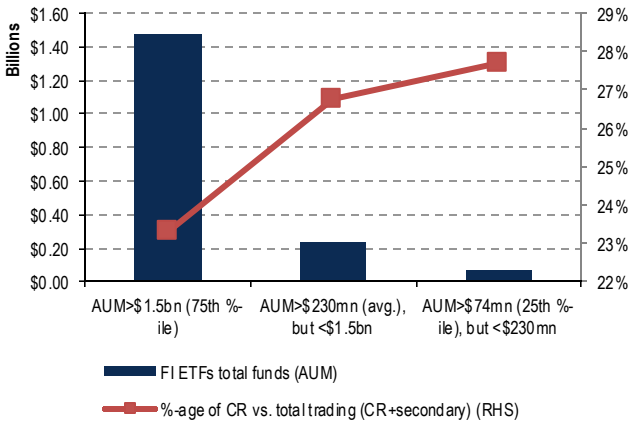
- On average, daily CR constitute a greater proportion (18%) of total trading for bond ETFs than for equity (10%) and commodity (9%) ETFs. However, HYG and in general HY corporate bond ETFs are more in-line with equity ETFs. FI ETFs are a growing segment of the ETF industry. As such, many small bond ETFs tend to have less established secondary markets. Indeed, Chart 21 shows that for bond ETFs with larger/smaller total funds (AUM), daily CR is a smaller/larger proportion of total trading.

Chart 20: ETF segments/ETFs where the CR activity represents a larger %-age of trading volume did not see a relative increase in CR activity during Q4-18, but the opposite



Source: BofA Merrill Lynch Global Research

Chart 21: For bond ETFs with larger/smaller total funds (AUM), daily CR is a smaller/larger proportion of total trading

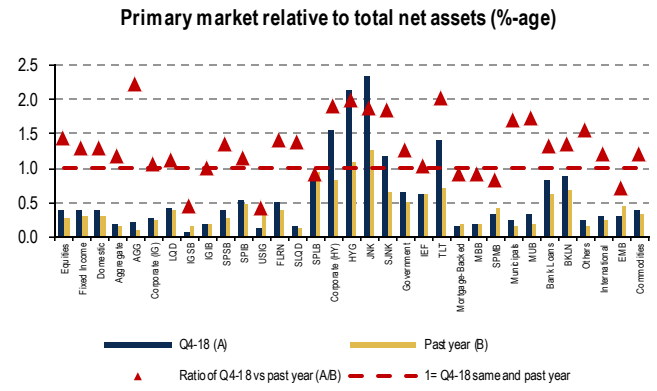


Source: BofA Merrill Lynch Global Research

- CR activity was typically higher relative to Total Net Assets during Q4-18 (for 75% of the ETF universe sampled in the table, see Chart 22). Among FI ETFs, HYG recorded the 2nd largest ratio of CR over Total Net Assets in 4Q-18 vs. the past year (see Chart 22). However, this still only amounted to ~2.0% of Total Net Assets.

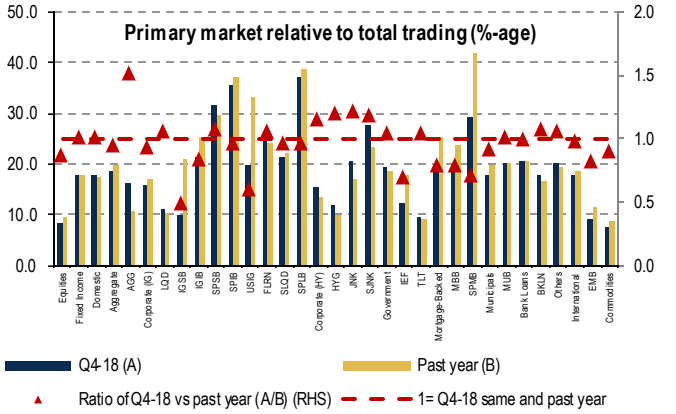
- In Q4-18, CR activity vs. total trading volume was typically very much in-line with the average over the past year (with some notable exceptions like AGG, where it was 1.5x as large) (see Chart 23). For HYG, it was only marginally higher (1.2x).

Chart 22: Among FI ETFs, HYG recorded the 2nd largest ratio of CR over Total Net Assets in 4Q-18 vs. the past year ; however, this still only amounted to ~2.0% of Total Net Assets



Source: BofA Merrill Lynch Global Research

Chart 23: In Q4-18, CR activity vs. total trading volume was typically very much in-line with the average over the past year (with some notable exceptions like AGG, where it was 1.5x as large)



Source: BofA Merrill Lynch Global Research

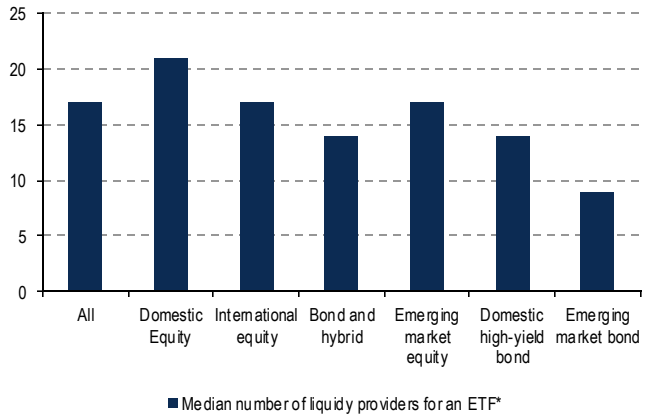
Are APs the only liquidity providers?

No. APs that are registered market makers are not the only entities that provide liquidity in the trading of ETF shares in the secondary market. In fact, there are a host of other entities that provide liquidity in ETF shares. APs that do not engage in market making simply facilitate creations and redemptions on behalf of their clients (which could include market makers, as well as end-investors seeking to access primary market liquidity). This distinction is important in the context of the so called 'step away' risk (see below, *"What happens if APs withdraw in unison?"*).

How many liquidity providers exist in the secondary markets?

ETF liquidity in regulated secondary markets is provided by Official Liquidity Providers (OLP), which are financial institutions (usually, but not exclusively, APs) that are committed to the exchange, not to the ETF sponsors. There are no requirements regarding the number of OLPs that should be engaged in providing liquidity for a given ETF. However, according to data from the Investment Company Institute (2018), in the United States ETFs had an average of 17 OLPs, with large differences across classes of ETFs (see Chart 24). Domestic equity ETFs have the most liquidity providers. But other types of ETFs—such as emerging market equity, domestic high-yield bond, and emerging market bond—also have multiple liquidity providers in the secondary market.

Chart 24: Domestic equity ETFs have the most liquidity providers. But other types of ETFs—such as emerging market equity, domestic high-yield bond, and emerging market bond—also have multiple liquidity providers in the secondary market



Source: BofA Merrill Lynch Global Research

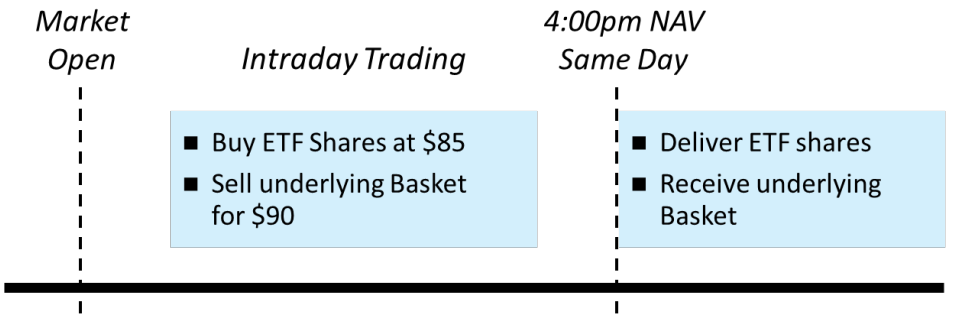
What are the economic incentives to support liquidity in an ETF's primary market?

ETF liquidity is reliant on market makers and APs being incentivized to provide it. This is the distinguishing factor and innovation of ETFs. Indeed, the act of listing and trading a fund on a stock exchange was not new or innovative; closed-end funds had been doing that before. What was new about ETFs was that they addressed a particular challenge of closed-end funds, which often trade at significant discounts or premiums to Net Asset Value (NAV), because the supply of shares is fixed and therefore investor demand (or lack thereof) manifests itself in the fund's trading price. ETFs address this challenge with their "open-end" investment structure, which allows ETFs to dynamically adjust their supply of shares to match changes in investor demand. This feature enables ETFs to trade typically close to NAV. APs straddle both the primary market and the secondary market, and this unique position enables them to benefit from an arbitrage opportunity whenever an ETF's secondary market price deviates too widely from the NAV.

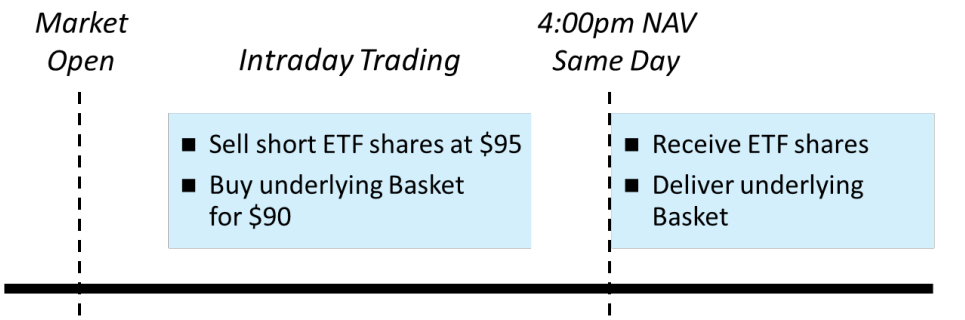
For example, if investor demand is strong for a particular ETF, that ETF's share price on the secondary market might be pressured above the value of its underlying securities. Whenever this happens, the AP can construct an arbitrage trade that sells short an "overpriced" ETF and buys the ETF's underlying portfolio of securities at a lower price than the ETF itself. At the end of the trading day, the AP delivers the underlying securities to the ETF manager in exchange for newly created ETF shares, which negates the AP's liability associated with having sold short the "overpriced" ETF. APs will repeat this trade until the ETF's secondary market price more closely aligns with the underlying portfolio's NAV and the arbitrage trade becomes uneconomical.

The process works the same in reverse. If an ETF begins to trade lower than its NAV, an AP can buy ETF shares on an exchange at discounted prices, sell short the underlying ETF portfolio, and then redeem the ETF shares with the fund for the underlying securities to close the short position. APs keep the price differential between the "underpriced" ETF and the fair value of the underlying securities (NAV), which essentially constitutes a payment for the service of keeping ETF pricing accurate and efficient (see chart below for an illustrative example).

ETF Arbitrage theoretical example (redemption): ETF costs $85, basket costs $90, expected profit of $5 (theoretical prices net of transaction costs)



ETF Arbitrage theoretical example (creation): ETF costs $95, basket costs $90; expected profit of $5 (theoretical prices net of transaction costs)



What happens if APs withdraw in unison ("step away" risk)?

While there is an economic incentive for creation or redemption based on premium/discount to NAV (see question above), APs are not obligated to create or redeem ETF shares. In the event an AP steps away from the market (for instance when the magnitude of an AP's bond inventory positions is large and risk bearing capabilities are limited, or for instance in periods of high volatility, low liquidity, and high short selling costs, which make arbitrage more difficult), other active or inactive APs may act upon the opportunity to interact with the ETF sponsor. As such, while bond ETFs only have a handful of APs that are active on a typical trading day, presumably there is incentive for other market makers to step in.

Here the distinction between market makers and APs comes in handy. The AP's "technology" or capability to create/redeem shares can be utilized by other participants such as market makers or liquidity providers (e.g., hedge funds), meaning that even if they choose not to deploy their capital, there is still a mechanism to adjust shares outstanding.

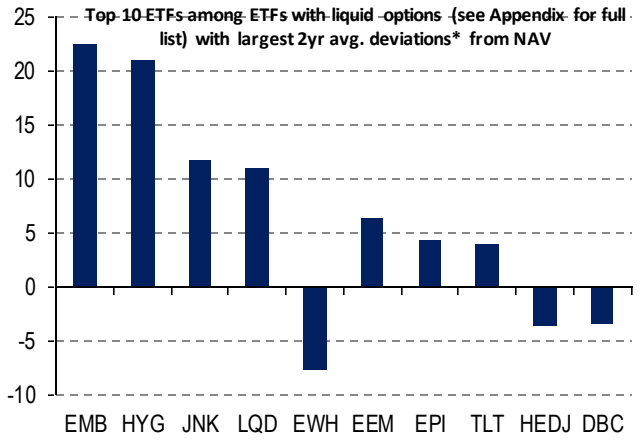
However, it is the case that discretionary liquidity, in the context of a crisis, is inherently "fragile", and one can imagine a situation where dealers and market makers will stop providing it once they start incurring losses, or their balance sheets are negatively impacted from other exposures and they can no longer bear the additional risk from providing the liquidity support. If indeed all APs were to step away because of a major market event, the ETF would trade like a closed-end fund (that is, a fund with a fixed number of shares) possibly with discounts until at least one AP were to resume its operations.

Importantly, there is also evidence (the case of Knight Trading Group in 2012, and Citigroup in 2013) of large APs withdrawing liquidity support and other APs, or registered market makers (who were not APs), stepping up to take their place.

Do ETFs typically trade close to NAV?

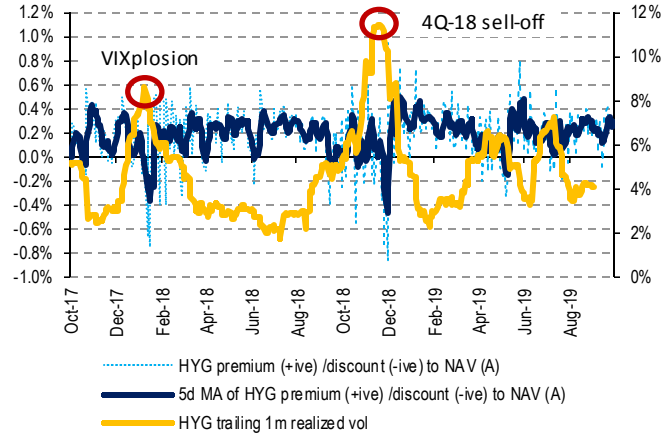
In theory, the arbitrage mechanism described above (see *"What are the economic incentives to support liquidity in an ETF's primary market?"*) should ensure that ETFs trade very close to NAV, net of transaction costs. While this is true, for instance, for domestic ETFs with liquid underlying assets (e.g., the median premium to NAV for SPY over the past two years was ~one tenth of a basis point), it is not the case for ETFs with relatively illiquid and/or international underlying securities (e.g., domestic HY/emerging markets bond ETFs) (see Chart 25), and especially in times of market stress (see Chart 26). For HYG, premiums and discounts may reflect the over-the-counter nature of the bond market. Individual OTC fixed income securities typically trade at much wider bid-ask spreads than listed domestic equity securities. The wide bid-ask spreads and relative lack of trading lead to larger arbitrage boundaries than typical equities; these spreads are reflected in market price deviations from NAV (note that fixed income ETF NAVs are typically marked to the bid side of the underlying market), relative to domestic equity ETFs.

Chart 25: ETFs with relatively illiquid and/or international underlying securities (e.g., domestic HY/emerging markets bond ETFs) have larger arbitrage boundaries, and as such, deviations from NAV are wider



Source: BofA Merrill Lynch Global Research. * Deviation to NAV = (Price – NAV)/NAV (in bps).

Chart 26: Price tends to deviate more during times of stress and heightened volatility, especially for ETFs with relatively illiquid underlying securities (HYG)



Source: BofA Merrill Lynch Global Research

Deviations from NAV in times of stress: sign of fragility or enhanced price discovery?

Deep discounts to NAV during times of heightened volatility and redemptions in HYG can be interpreted in two ways: i) a partial breakdown of arbitrage, for instance, because of trade frictions (e.g., higher borrowing costs), and the inability/reluctance of ETF market makers to hold a basket of illiquid bonds in return for the delivered ETF shares, or ii) underlying index values, which are calculated once daily based on known previous bond transactions or estimates of value (neither of which may be updated frequently during stressed markets) tend to adjust to new market levels with a lag. In other words, it may be the case that secondary market liquidity and lower bid-ask spreads make HYG the exposure vehicle of choice in times of stress. On the other hand, infrequent trading of the underlying bonds in the OTC market could translate into staleness in prices (stale = past price does not reflect the most recent information), which in turn makes NAV adjust more slowly, causing discounts to widen. In that sense, HYG would contribute to price discovery.

How is NAV determined?

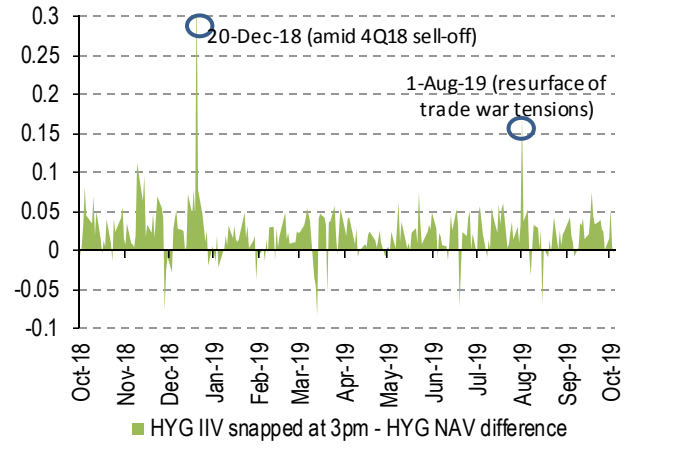
The NAV of HYG is determined daily at the close based on available bid prices or current market quotations provided by dealers or supplied by the ETF's approved independent third-party pricing services. When market quotations are not readily available or are believed by BlackRock Fund Advisors (BFA) to be unreliable, the ETF's investments are valued at fair value. In other words, BFA may conclude that a market quotation is not readily available or is unreliable if a security or other asset or liability does not have a price source due to its lack of trading. Fair value represents a good faith approximation of the value of an asset or liability, i.e., the amount that can reasonably be expect to be received from the current sale of that asset or the cost to extinguish that liability:

"Valuing the Fund's investments using fair value pricing will result in prices that may differ from current market valuations and that may not be the prices at which those investments could have been sold during the period in which the particular fair values were used" [2019 HYG prospectus]

How is intra-day indicative value (IIV) determined?

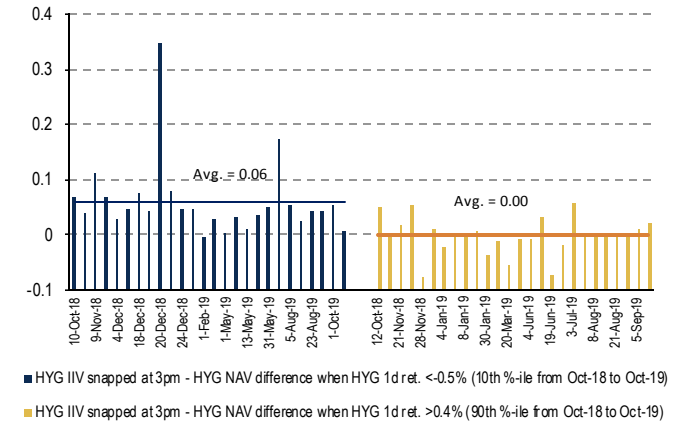
Transparency of an ETF's holdings enables investors to observe and attempt to profit from discrepancies between the ETF's share price and its underlying value during the trading day. ETFs contract with third parties (typically market data vendors) to calculate and publish a real-time estimate of an ETF's underlying value. This calculation, often called the intraday indicative value (IIV), is based on the prior day's holdings and is disseminated at regular intervals during the trading day (typically every 15 seconds). APs, market makers, and other institutional investors also can make this assessment in real time using their own computer programs and proprietary data feeds. On Bloomberg (BBG), the NAV for HYG is typically updated at 2:00 GMT T+1 (i.e., the value for 10/25 is updated on 10/26 2:00 GMT), and disseminated by the fund admin. As for the IIV, this is stored on BBG as HYGIV Index and is disseminated by the NYSE ARCA (on which HYG is listed), which also performs the calculation. The IIV for HYG can differ significantly from its NAV (see Chart 27), with the IIV – NAV spread being largely positive on days when HYG post relatively large and negative returns; on the other hand, the spread is on average zero on days when HYG posts relatively large and positive returns (see Chart 28).

Chart 27: The IIV for HYG can differ significantly from its NAV…



Source: BofA Merrill Lynch Global Research

Chart 28: …with the IIV – NAV spread being largely +ive on days when HYG post relatively large & -ive ret., and on avg. 0 on days when HYG posts relatively large & +ive returns



Source: BofA Merrill Lynch Global Research

Do index-based ETFs have to replicate the target index?
Not necessarily. An index-based ETF may replicate its index (that is, it may invest 100 percent of its assets proportionately in all the securities in the target index), or it may sample its index by investing in a representative sample of securities in the target index.

Representative sampling is a practical solution for ETFs that track indexes containing securities that are too numerous or that are difficult to obtain (some fixed-income securities). For HYG, BFA uses representative sampling. HYG generally invests at least 90% of its assets in the component securities of the underlying index it is targeting (the Markit iBoxx USD Liquid High Yield Index) and may invest up to 10% of its assets in certain futures, options and swap contracts, cash and cash equivalents, as well as in securities not included in the underlying index but which BFA believes will help the fund track the underlying index.

From time to time when conditions warrant, the proportion of assets not included in the underlying index can double to 20%. This flexibility is a by-product of the fact that HYG is structured as a registered open-end management investment company. Most ETFs are structured as such.

Notably, much fewer ETFs are organized as Unit Investment Trusts (UITs). They are among the earliest ETFs (e.g., SPY, QQQ). These ETFs must have fixed portfolios, and substitution of securities may take place only under limited circumstances. Additionally, these ETFs are generally limited to replicating (rather than sampling) the index they track.

What basket of securities does the ETF sponsor receive/deliver in the CR process?
At the end of each trading day, the ETF manager issues the portfolio composition file (PCF), which lists the names and corresponding quantities of securities and/or cash that will comprise the creation and redemption baskets for the next trading day.

The creation/redemption basket is a specific list of names and quantities of securities, cash, and/or other assets. Often, baskets will track the ETF's portfolio through either a pro rata slice or a representative sample, but, at times, baskets may be limited to a subset of the ETF's portfolio and contain a cash component. For example, the composition of baskets for bond ETFs may vary day to day with the mix of cash and the selection of specific bonds in the baskets based on liquidity in the underlying bond market (for instance, HYG typically excludes bonds that have not traded for 30 consecutive days).

Indeed, the fund may in certain circumstances offer or receive creation units partially or solely for cash, particularly when an instrument in the creation basket is difficult to obtain or transfer. For instance, based on SEC filings (Form N-CEN), in the year ending 2-Feb-19, Goldman Sachs and Jane Street Capital each bought from the Fund $2.5mn worth of iShares Edge High Yield Defensive Bond ETF (HYDB), 100% of which was composed of cash.

Typically, the composition of an ETF's daily creation and redemption baskets mirror one another. However, for ETFs where SEC exemptive relief applies (as is the case for HYG), an ETF portfolio manager may choose, at times, to differentiate the creation and redemption baskets. For example, HYG may require different securities for the creation and redemption baskets when the underlying index is rebalancing to avoid taking in securities that are leaving the index.

In short, there is a lot of flexibility in the composition of the creation/redemption baskets. Furthermore, in practice, the creation/redemption baskets are not necessarily the baskets that a fund will receive/deliver. The ultimate makeup of the basket will be determined as the result of a negotiation between the fund and the specific AP/market maker engaged in the transaction. In other words, different APs will deliver/receive different baskets, based, for instance, on their inventories, liquidity needs, business relationship, etc.

Options Risk Statement

Potential Risk at Expiry & Options Limited Duration Risk

Unlike owning or shorting a stock, employing any listed options strategy is by definition governed by a finite duration. The most severe risks associated with general options trading are total loss of capital invested and delivery/assignment risk... all of which can occur in a short period.

Investor suitability

The use of standardized options and other related derivatives instruments are considered unsuitable for many investors. Investors wishing to partake in these strategies are encouraged to become familiar with the "Characteristics and Risks of Standardized Options" (an OCC authored white paper on options risks). U.S. investors should consult with a FINRA Registered Options Principal.

For detailed information regarding the risks involved with investing in listed options: http://www.theocc.com/about/publications/character-risks.jsp

Specific risks to covered call strategies: If the stock finishes below the noted "breakeven point" at expiry, the investor's position will be valued lower; however, any discount in value will be partially offset by option premium received. If the stock finishes above the noted strike on expiry, the investor may have their underlying shares called-away (sold); however, realizing a profitable capped return equaling the noted call-away return.

- When the underlying stock price meaningfully lies above the short call strike price, the investor is at risk of having their underlying shares called-away (sold). Holders can employ the following tactics to avoid call-away:

Roll-out (Roll Forward): Buy back the calls that were originally sold and sell same strike calls at a later expiry. Because of the time value, this transaction usually results in an initial net credit.

Roll-up: Buy back the calls that were originally sold and sell higher strike calls at the same expiry. Because of intrinsic value, this transaction usually results in a net debit.

Roll-up & out: Buy back the calls that were originally sold and sell higher strike calls at a later expiry. The transaction can result in either a net debit or credit.

- When the underlying stock price meaningfully underperforms, the investor will have an opportunity to shift strikes and/or expiries to generate further income.

Roll-out (Roll Forward): Buy back the calls that were originally sold and sell same strike calls at a later expiry. Because of the time value, this transaction usually results in an initial net credit.

Roll-down: Buy back the calls that were originally sold and sell lower strike calls at the same expiry. Because of intrinsic value, this transaction usually results in an initial net credit.

Roll-down & out: Buy back the calls that were originally sold and sell lower strike calls at a later expiry. Because of time value and intrinsic value, this transaction will result in an initial net credit.

General return risks associated with covered call strategies

While covered call strategies will underperform stocks in fast bull markets, they will still realize significant profits. Covered call strategies tend to outperform outright stock ownership in flat, down and slightly up markets.

Covered call strategies allow clients to increase their yield on equity positions in exchange for giving up some of the potential upside in the underlying securities. While covered call strategies will underperform stocks in fast bull markets, they will still realize significant profits. Covered call strategies tend to outperform outright stock ownership in flat, down and slightly up markets. Covered call strategies tend to dampen the effects of general market volatility by offsetting outlier returns. The payoff properties of the covered call, capped upside returns and reduced downside returns (offset by option premiums received), work to truncate holding period returns towards the mean and reduce the overall standard deviation of a sample portfolio. These properties are reflected by a portfolio net delta that is less than 100% (typically between 65-90%). By definition, a long stock-only position exhibits a constant 100% delta.

Option Liquidity Risk

While we believe the recommended options are liquid and appropriate for covered call writing, the premiums noted can change rapidly and adversely. Investors should consider these factors before executing a transaction.

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