Tail-risk hedging, dividend chasing, and investment constraints: The use of exchange- traded notes by mutual funds

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ABSTRACT

Our study examines mutual fund demand for a newly designed security, exchange-traded notes (ETNs). We find strong evidence that mutual fund long positions in ETNs significantly underperform and that the motivations to hold ETNs lie outside of maximizing returns. Mutual funds hold ETNs to hedge tail risk and to gain access to higher dividend yields. Mutual funds have a strong preference for derivative-like ETNs although this preference is unrelated to contractual constraints. Finally, we show that skilled timing of ETN investments is limited to the short-sales market.

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1. Introduction

Mutual funds in the United States hold over $16.3 trillion in assets.[1] Given the size of the mutual fund industry, numerous studies examine mutual fund holdings of equities (Daniel et al., 1997), derivatives (Koski and Pontiff, 1999; Cici and Palacios, 2015), short positions (Chen et al., 2013), and, most recently, exchange-traded funds (Sherrill et al., 2017). We investigate the possible incentives that prompt mutual funds to purchase exchange-traded notes (ETNs). Our focus is on several motivations, including maximizing returns, reducing risk, gaining access to dividend yields, and holding derivative-like securities without having to worry about derivative-related investment constraints.

Our results, like those found for exchange-traded funds (ETFs) by Sherrill et al. (2017), show that ETN investments made by mutual funds tend to underperform. The question thus arises: If fund managers do not select ETNs based on the ability to outperform, why are they investing in ETNs? To answer this, we associate a range of ETN features with mutual fund holdings of ETNs. Our findings provide evidence that certain ETNs offer return patterns that fund managers value in specific situations. We show that demand for ETN characteristics related to risk reduction and access to dividend yields are important considerations for mutual fund managers. For example, fund managers make allocation decisions to ETNs tracking the Chicago Board Options Exchange Volatility Index (VIX) in a manner consistent with the hedging of left-tail risk. Likewise, mutual funds hold ETNs linked to master limited partnerships (MLP) when high dividend-yielding securities are most attractive (Jiang and Sun, 2015). Mutual funds display a preference for derivative-like ETNs although no evidence exists that mutual fund-specific requirements or constraints drive this preference. We conclude that the small losses funds

[1] From the Investment Company Institute. Data as of year-end 2016. https://www.ici.org/pdf/2017_factbook.pdf

experience on long positions in ETNs may be viewed as fees paid by fund managers for access to the complex risk-return profiles that ETNs offer.

After considering the motivations for fund managers to hold ETNs, we conclude by looking at short positions and find that mutual fund managers demonstrate skill when short-selling ETNs. ETN characteristics provide a unique test of skill in mutual fund short positions. Specifically, we show that the mechanics of the short-sale market are associated with skilled trading, but long positions in inverse ETNs provide no evidence of skilled trading by fund managers.

Our examination of mutual funds' investments in ETNs shows support for portfolio management motivations rarely included in academic models or empirical analyses. We show that simple models of mutual fund ability can be inadequate when explaining portfolio allocation decisions among specialized security designs, such as that of ETNs. A wide range of incentives can motivate fund managers to hold securities to enhance portfolio risk-return characteristics in ways that would be difficult to achieve with traditional equities. Because ETNs allow access to return patterns that may have been too costly or restrictive for fund managers with traditional securities, we are able to document fund managers' preferences for novel return profiles and characteristics. We therefore unite two areas of academic research: portfolio management and security design.

We organize the remainder of our paper as follows: Section 2 provides a brief overview of ETNs and describes our motivation and hypotheses: Section 3 outlines the data sources and testing methodologies used: Section 4 presents the results of our analysis: Section 5 discusses our results and the implications for future research.

2. Background, motivation, and hypotheses

Determining why portfolio managers choose to hold securities that do not outperform can be difficult. Prior research documents a range of incentives that prompt fund managers to pursue goals other than shareholder return maximization, including decisions concerning risk-taking (Brown et al., 1996; Golec and Starks, 2004; Kempf et al. 2009; Huang et al. 2011), style tilts (Chevalier and Ellison, 1999; Chan et al. 2002; ter Horst et al. 2004), and herding (Boyson, 2010; Jiang and Sun, 2014). We extend these works by showing that managerial incentives deviate from simple return maximization in the case of ETNs.

2.1 Structure and history of ETNs

ETNs are market-listed unsecured debt securities whose principal value tracks a designated market index.[2] ETNs have no underlying portfolio holdings and are backed by the credit of the issuing institution, usually a global investment bank (although issuers' default risks are not found to be reflected in ETN prices [Cserna et al., 2012]). The June 2006 introduction of ETNs in the US created a new opportunity for mutual funds. Because ETNs hold no underlying securities, tracking indices with difficult or impossible-to-hold underlying constituent securities (e.g., the VIX) is possible. ETNs, therefore, may offer returns that are similar to those obtained through derivatives positions, insurance contracts, and unlisted securities. However, ETNs are classified as market-traded bonds and are not subject to the constraints on senior securities imposed by the Investment Company Act of 1940 and many mutual fund prospectuses. Due to this distinction, ETNs allow mutual funds to hold a security that meets regulatory and contractual

[2] For further discussion on the basic functioning of an ETN security, see Wright et al. (2010). Cserna et al. (2012) provide a more focused analysis by looking at the counterparty risk in ETNs.

guidelines, while providing returns that mimic those of securities the fund may be constrained from holding.

2.2 Selection of ETNs based on fund managers' skilled forecasting

The simplest explanation for why mutual fund managers choose to hold ETNs is that these managers possess the skill or private information that allows them to outperform through ETN investments. Because ETNs are relatively new, illiquid, and complex securities, market inefficiencies could exist for ETNs even when more liquid securities, such as common stocks, show little evidence of future price predictability. We base our initial hypothesis on the possibility that mutual fund managers select ETNs with predictable future prices. Our first alternative hypothesis is as follows:

> **H_1:** Mutual fund managers select ETNs based on skilled forecasts of ETN returns, which implies a positive association between ETN holdings and future ETN returns.

Because simple and persistent return predictability is rare in developed financial markets, our first hypothesis likely does not fully explain mutual fund preferences for ETNs. We therefore consider several additional hypotheses based on the unique characteristics of ETNs that allow for return patterns that depart from the returns of more commonly held securities.

2.3 Using ETNs for tail-risk hedging

Several characteristics of ETNs make their use for hedging purposes more efficient than other securities. The ability to track indices implicitly tied to measures of market risk, such as the

VIX, means that ETNs can act as protection against certain types of market risk that would otherwise be more difficult or costly for investors.

Because the VIX fluctuates and lacks a long-term time trend, investments in VIX-based ETNs should decrease by the amount of the fees charged over long horizons. While this may make VIX-based ETNs poor long-term investments in terms of unconditional returns, VIX-based ETNs increase in value when market uncertainty increases and the marginal utility of investors is high. A negative average return on these investments may be an acceptable cost for an insurance-like security that can provide a hedge against uncertainty, especially on the left-hand side of the return distribution.

Bhansali (2008) and Bhansali and Davis (2010) provide a practical guide to how correctly priced tail-risk hedges can benefit both retail and institutional investors. The suitability of VIX-derived securities for tail-risk hedging follows from several studies of market volatility and volatility of volatility, such as Park (2015) and Agarwal, Arisoy et al. (2016). VIX-based ETNs are a prime candidate for mutual fund managers to purchase such hedges at a potentially lower cost than was previously available.

The impact of exposure to left-tail risk on managed portfolios is detailed in studies such as Agarwal and Naik (2004), Kelly and Jiang (2014), and Agarwal, Ruenzi et al. (2016). Heuson et al. (2016) document the demand from investors (in hedge funds) for exposure to, or avoidance of, tail risk. Motivated by the importance of tail-risk management to hedge funds, we test if mutual funds use VIX-based ETNs as a tool to manage portfolio risk. A successful hedging instrument would allow mutual funds to reduce portfolio risk, especially during extreme market downturns. To test this, our second alternative hypothesis is as follows:

H_2: Funds hold VIX-linked ETNs to hedge against market volatility, which implies that holdings of such ETNs are negatively associated with fund risk, especially during times of extreme market volatility.

2.4 Using ETNs to chase dividend yields

The use of ETNs for tail-risk hedging may provide only a partial explanation for why mutual funds hold ETNs that do not simply boost portfolio returns. A popular category of ETNs tracks the indices of master limited partnerships, which are specialized ownership structures that allow for the pass-through of distributions from activities such as capital-intensive natural resource extraction (Ciccotello and Muscarella, 1997). The distribution features of MLPs allow high-dividend payout ratios. However, the illiquidity and regulatory treatment of direct MLP investments limit the usefulness of directly holding MLPs by mutual funds. Therefore, ETNs could represent a more efficient avenue to gain the high dividend yield payouts of MLPs without directly holding MLP securities.

Jiang and Sun (2015) suggest that a mutual fund's preference for high dividend yield securities is dependent on the level of interest rates. When interest rates are unusually and persistently low, high-dividend securities become more attractive, relative to bonds, to investors who wish to maintain fixed streams of income. The association should be particularly strong for income-oriented mutual funds. Several characteristics of our data allow us to independently test the Jiang and Sun model while concurrently exploring if dividend yield-chasing provides an explanation for why mutual funds hold MLP-linked ETNs. The time since the introduction of MLP-linked ETNs can be characterized as including low interest-rate periods. MLP-linked ETNs provide the type of high dividend yields that should be preferred by funds under these conditions.

We use the possibility that funds are reaching for dividends as motivation for our third hypothesis.

> **H_3:** Mutual funds use MLP-linked ETNs to obtain greater exposure to dividend yields, especially in low interest rate environments, which implies a negative association between interest rates and funds' holdings of MLP-linked ETNs, especially for income-oriented funds.

2.5 Using ETNs to circumvent constraints on derivative holdings

The characteristics of ETNs that allow for tail-risk hedging and the chasing of dividend yields arise from the fact that ETNs can track nonequity indices. This aspect provides additional opportunities for mutual funds to bypass constraints on the securities that they hold. Regulators, fund boards, and fund families are all sources of mutual fund constraints (Almazan et al., 2004; Cao et al., 2015; Chen et al., 2013). While concerns may arise about the risks to investors from exposure to the returns of derivative securities, the constraints embedded in regulations and fund prospectuses stem from the structure of derivative contracts. The structure of ETNs as market-traded securities alleviates these constraints.

If constraints on entering into derivative contracts prevent mutual funds from accessing return patterns they would otherwise prefer, then greater demand for ETNs that have more derivative-like characteristics may be evident. This idea motivates H_{4A}.

H_{4A}: Funds use ETNs as an alternative to derivative contracts that they are constrained from holding, which implies a positive association between derivative-like characteristics of ETNs and fund holdings of those ETNs.

An alternate way to evaluate the use of ETNs for avoiding derivative constraints is to examine the characteristics of the funds that hold ETNs instead of the characteristics of the ETN. Almazan et al. (2004) find that smaller fund families, older funds, funds that charge load fees, team-managed funds, and funds with lower turnover are more likely to face constraints. We therefore expect constrained funds to make more use of ETNs.

H_{4B}: Funds use ETNs as an alternative to derivatives contracts that they are constrained from holding, which implies greater ETN holdings by more constrained funds, especially for derivative-like ETNs.

2.6 Using ETNs based on forecasting skill in specialized settings

Short selling entails more risk and higher costs than long positions in a security. The Investment Company Institute notes that mutual funds must fully cover their short positions, which limits the number of short positions a mutual fund can hold.[3] Thus, mutual funds may pursue short selling as an investment strategy only if they have confidence in future (negative) returns. Boehmer et al. (2008) suggest that most short-sellers are skilled, and Chen et al. (2013) report the same finding for mutual fund managers. The ability of fund managers to predict

[3] See http://www.ici.org/files/faqs_hedge.

negative future performance could be independent of the ability to successfully predict positive future performance.

Our data on ETNs allow us to test if the amount of short interest in ETNs corresponds to a set of security positions in which mutual fund managers accurately predict future price movements. With our sample of ETN data, an additional unique opportunity presents itself: because our sample includes inverse ETNs, we test whether the skill in forecasting negative returns is an ability that fund managers have for downside forecasting in general, or if their skills manifest themselves only when taking short positions. Our last hypothesis is as follows:

> **H_5:** Mutual fund managers display skill when short selling ETNs, which implies a negative association between mutual funds' short selling of ETNs and future returns on those ETNs.

3. Data and methods

In this section, we provide details of our data sources, sample creation, basic descriptive statistics of ETN use, and methodology.

3.1 Data sources

We use mutual fund data from the Center for Research in Security Prices Survivor-Bias-Free US Mutual Fund Database (CRSP MF), which allow for a detailed analysis of mutual funds that hold ETNs between June 2006 and December 2015. We begin our analysis in 2006 because it is the first year that ETNs trade on US markets. From CRSP MF, we obtain mutual fund and ETN characteristics. To avoid counting each share class as a stand-alone mutual fund, we

aggregate mutual fund share classes into one total net asset (TNA)-weighted portfolio. We calculate mutual fund characteristics such as performance, turnover, expense ratios, and cash as the TNA-weighted average across mutual fund share classes. A characteristic of this database is that, in addition to mutual funds, it includes (limited) data on ETNs. This allows us to not only obtain ETN characteristics but to also identify mutual funds that hold ETN positions. After removing ETNs with missing data, we identify 279 unique ETNs in CRSP MF.

We obtain additional ETN characteristics from the Bloomberg Professional database, such as indicator variables for whether the ETN is leveraged or inverse as well as the type of asset the underlying index tracks (equity, commodity, currency, MLP, or fixed income, among others). To capture all ETNs providing return structures that allow for tail-risk hedges, we include both VIX-linked ETNs and gold-tracking ETNs in our definition of VIX ETNs. To ensure that we do not inadvertently include inverse ETNs, we require that VIX-identified ETNs have positive correlations with the returns of the VIX. To determine if an ETN is derivative-like, we utilize ETN names from Bloomberg in conjunction with hand collected information from the ETN issuers' websites. We obtain index details from prospectuses, Snapshots, and Factsheets. If an index's description states that it is composed of derivative products, then we identify it as derivative-like. For example, the iPath Bloomberg Agriculture Subindex Total Return^{SM} ETN (ticker: JJA) has an index description stating, "the index is currently composed of seven futures contracts on agricultural commodities which are included in the Bloomberg Commodity Index Total Return^{SM}" and as such, we classify it as derivative-like.[4]

We retain all ETNs traded on US markets and denominated in US dollars. This approach avoids problems that may arise from currency conversions (see Milonas and Rompotis [2010] for

[4] See http://www.ipathetn.com/US/16/en/instruments.app?categoryId=2#/details/23347.

a discussion of this). Furthermore, focusing on one country mitigates problems related to variations in market characteristics such as trading activity, risk, transaction costs, regulations, and taxes. To avoid survivor bias, we include both active and inactive securities. We merge data from Bloomberg and CRSP MF by ETN Committee on Uniform Securities Identification Procedures (CUSIP) number and ticker, and we hand-check the accuracy of our merged data set. We retain only those ETNs with available data in both databases. The resulting final combined sample has 270 unique ETNs, 340 unique mutual funds that hold ETN positions, and 90 ETNs held by mutual funds.[5]

Figure 1 presents the number of ETNs held, and not held, based on the sponsoring institution of each ETN. Barclay's Capital Inc. and UBS Global Asset Management dominate the sponsorship of ETNs in our sample; however, the proportion of ETNs held by mutual funds varies considerably across sponsors. Figure 2 depicts the number of ETNs in our sample that are held, or not held, by mutual funds each year. The number of ETNs issued and held by mutual funds, increased rapidly until 2011, after which it stabilized.

[Insert Figure 1 about here]

[Insert Figure 2 about here]

Panel A of Table 1 describes the characteristics of ETNs in our sample, categorized by those ETNs that are held by mutual funds and those that are not. Mutual funds tend to hold ETNs

[5] See Table A1 for additional information on the top ETNs offered and held, Table A2 for the proportion of ETNs held by mutual funds based on ETN objective, and Table A3 for mutual fund holdings characteristics based on ETN objective.

that are less expensive, larger, older, and more liquid. Panel B presents the proportion of each ETN index type that is held by a mutual fund. The three most popular index types are those that track MLPs (58% of MLP-tracking ETNs are held by a mutual fund), those that track VIX-linked indices (42% of all VIX-linked ETNs are held by a mutual fund), and ETNs that provide 200% leveraged index returns (41% of all 200% leveraged ETNs are held by a mutual fund). In contrast, only 6.7% of 300% leveraged ETNs are held by a mutual fund.

[Insert Table 1 about here]

Mutual funds rarely hold ETNs for the entire period that a fund appears in our sample. Panel C of Table 1 presents descriptive statistics on how the characteristics of ETNs vary over the months when the ETN is held or not held by a fund. Out of a total of 6,434 monthly ETN observations, our sample contains 2,479 ETN-months in which an ETN is held by a fund and 3,955 ETN-months in which an ETN is not. Of ETNs held by funds, the holdings tend to be concentrated during the ETN-months when returns are lower, providing initial doubt regarding our hypothesis (H_1) that funds hold ETNs based on skilled performance forecasts.

Much of the subsequent analysis relies on a matched sample of mutual funds that have never held an ETN position. We create our matched sample of non-ETN-holding mutual funds by first matching on mutual fund investment objective. From the sample of all objective-matched non-ETN-user mutual funds, we require the potential matched funds to have data for the same months as the ETN-holding mutual fund. We retain the fund with the closest total net asset value to the ETN-user mutual fund. Table 2 reports the descriptive statistics for our two mutual fund subsamples.

We show that ETN-user mutual funds are more likely to be a member of a family, which is on average smaller than non-ETN-user mutual fund families. ETN-user mutual funds also have higher turnover, are younger than non-ETN-user funds, experience reduced volatility, and have lower monthly fund returns.

[Insert Table 2 about here]

3.2 The general characteristics of ETNs held by mutual funds

Like equities, ETNs display characteristics that involve time-varying patterns in returns, liquidity, market capitalization, and risk. Following Falkenstein (1996), we combine time series ETN characteristics with mutual fund holdings data to examine their relation to the likelihood of a mutual fund holding an ETN. Based on the Falkenstein (1996) ownership variable, we calculate our measure of ETN ownership as:

$$ETN\ Shares\ Held_{i,t} = \frac{\sum_{m=1}^{M} shares\ long\ of\ ETN\ i\ by\ fund\ m\ at\ time\ t}{shares\ outstanding\ of\ ETN\ i\ at\ time\ t}, (1)$$

where *t* is the month during which the mutual fund reported holding ETN *i*. This equation measures the fraction of outstanding shares of ETN *i* held by any mutual fund in a given month. In our multivariate analysis, we look at long and short positions separately. Therefore, the numerator is the number of shares owned long. We cluster error terms by ETN as in Petersen (2009). The model is

$$ETN\ Shares\ Held_{i,t} = \alpha + \sum_{j=1}^{n} \beta_j X_{i,t-1} + FE + \varepsilon_{i,t}, (2)$$

where *ETN Shares Held*$_{i,t}$ is defined as in Eq. (1) and allows us to determine the time series characteristics associated with mutual fund ownership of an ETN. The independent variables include ETN characteristics that may relate to mutual fund demand. *Market Return* is the average monthly market return for a given ETN. *Market Volatility* is the standard deviation of daily market returns for an ETN measured over a month. *ETN Size* is the natural log of the ETN's market capitalization. *Price* is the natural log of the ETN's average price over a month. *Age* is the natural log of the ETN's age. *Volume* is the number of shares traded each day standardized by the total number of shares outstanding, averaged over a month. *FE* represents objective and year fixed effects. Eq. (2) allows us to judge the performance, risk, and liquidity characteristics associated with a mutual fund holding an ETN.

3.3 Modeling the skill of mutual fund managers when investing in ETNs

The dependent variable for the analysis of mutual fund skill in ETN holdings is the average daily market return for a given ETN, *ETN Returns*. We examine the relationship between the proportion of ETN shares held by mutual funds and subsequent returns. We define *ETN Shares Held* as in Eq. (1). Controls include ETN liquidity (*Volume*), volatility (*Volatility*), price (*Price*), age (*Age*), and size (*ETN Size*). We also incorporate lagged returns (*ETN Return*) to account for potential momentum or mean reversion in ETN returns. Objective and year fixed effects (*FE*) are included. We cluster errors at the ETN level. The regression model is

$$ETN\ Return_{i,t} = \alpha + \beta_1 ETN\ Shares\ Held_{i,t-1} + \sum_{j=2}^{n} \beta_j X_{i,t-1} + FE + \varepsilon_{i,t}\,. \quad (3)$$

Rejection of our first null hypothesis requires a significant positive coefficient for *ETN Shares Held*$_{i,t-1}$. This result would be consistent with mutual funds' skilled forecasting of future ETN returns. We measure control variables over the prior period for each ETN and define variables as in Eq. (2).

3.4 Modeling the characteristics of ETN indices held by mutual funds

Given the potential for ETNs to provide mutual funds with a means to circumvent investment constraints and to provide mutual funds with access to nontraditional asset classes, we emphasize characteristics related to derivative-like ETNs, inverse ETNs, leveraged ETNs, and underlying index asset type. Because index characteristics rarely change over our sample period, we employ the following cross-sectional regression model to explore relationships between ETN index characteristics and the likelihood of a mutual fund holding an ETN:

$$ETN\ Held_i = \alpha + \sum_{j=1}^{n} \beta_j X_i + FE + \varepsilon_i\,, (4)$$

In Eq. (4), the binary dependent variable, *ETN Held*, equals one if an ETN *i* is held by a mutual fund at any point over our sample period and zero otherwise. All independent variables are indicator variables related to the ETN's return or index characteristic. *VIX* and *MLP* take on a value of one if the underlying index is linked to the VIX or MLP and zero otherwise. *Derivative-like* takes on a value of one if the ETN has a derivative-like return structure and zero otherwise. *Leveraged 200%* and *Leveraged 300%* take on a value of one if the ETN provides leveraged returns of 200% or 300%, respectively, and zero otherwise. *Inverse 100%, Inverse 200%,* and *Inverse 300%* take on a value of one if the ETN provides inverse returns of an index of -100%,

inverse-leveraged returns of -200%, and inverse-leveraged returns of -300%, respectively, and zero otherwise.

Eq. (4) allows for an initial evaluation of H_2, H_3, H_{4A}, and H_{4B}. A significant and positive coefficient on *VIX* would be consistent with a fund's preference for VIX-linked ETNs, as implied by H_2. A significant positive coefficient for *MLP* would be consistent with a preference for MLP-linked ETNs, as implied by H_3. A significant positive coefficient estimate for *Derivative-like* would be consistent with funds using ETNs to obtain derivative-like returns as implied by H_{4A} and H_{4B}.

3.5 Modeling the use of ETNs for tail-risk hedging

If VIX-based ETNs are successful hedges against market risk, then a reduction in a mutual fund portfolio's risk should be evident from an investment in VIX-linked ETNs. We test how the standard deviation of a fund's returns is associated with the holdings of VIX-based ETNs:

$$Standard\ Deviation_{i,t} = \alpha + \beta_1 Hold\ VIX_{i,t} + \sum_{j=2}^{n} \beta_j X_{i,t-1} + FE + \varepsilon_{i,t}\,, (5)$$

where *Standard Deviation*$_{i,t}$ is the standard deviation of daily returns for fund *i* in month *t*. *Holds VIX*$_{i,t}$ is an indicator variable equal to one if a fund holds a VIX-linked ETN in month *t* and zero otherwise. We use, as control variables, measures shown in past studies to be associated with mutual fund risk: *Fund size* is the natural log of the mutual fund's total net assets, *Fund Age* is the natural log of the mutual fund's age, *Family TNA* is the natural log of the total net assets of

the fund's family, *Turnover* is the turnover ratio of fund *i* as reported in CRSP MF, and *Cash Held* is the percent of cash and cash-equivalent securities in the portfolio of fund *i* in month *t-1*.[6]

We report estimates from Eq. (5) progressing through several refinements of our mutual fund sample to examine the use of VIX-linked ETNs to reduce portfolio risk. We begin with a sample of all fund-months for both ETN-holding funds and our matched sample of non-ETN-holding funds. We thus can test if VIX holders display a reduction in risk relative to both non-ETN-holding funds and compared with funds that hold ETNs but not VIX-linked ETNs. We then estimate the model for only ETN-holding funds to determine if any reduction in risk is due to VIX-linked ETN holdings and not to ETN holdings in general. Of the funds that hold VIX-linked ETNs, we test if the months they hold VIX ETNs are associated with a reduction in risk relative to months these funds do not hold VIX ETNs.

Next, we examine the usefulness of VIX-linked ETNs to hedge extreme left-tail risk by limiting our sample to those fund-months drawn from the bottom decile of market returns. This specification captures the spirit of more complex models of tail-risk hedging, such as those developed by Agarwal, Ruenzi, et al. (2016). Last, we estimate the model for all funds that hold ETNs at some point during the sample period, modifying our *Holds VIX* variable to take a value of one for funds that hold VIX-linked ETNs at any point. We then drop all time periods when these funds hold VIX-linked ETNs. This requirement allows us to examine if there are risk-reducing characteristics of funds that are prone to hold VIX-linked ETNs, even in those periods when they do not hold VIX-linked ETNs. If holding VIX-linked ETNs results in a reduction in portfolio risk rather than the characteristics of the funds holding VIX-linked ETNs, the estimate for our modified *Holds VIX* variable should not be significant in this specification.

[6] We follow the approach of Sherrill et al. (2017) and winsorize cash at the bottom 1% and top 5%.

3.6 Modeling the use of ETNs to chase dividend yields

According to the analysis of Jiang and Sun (2015), mutual funds should reach for high dividend yield securities in periods of low interest rates. We therefore estimate the association between interest rates and the demand for MLP-linked ETNs by mutual funds. Our model is

$$MLP\ Shares_{i,t} = \alpha + \beta_1 Risk\ Free\ Rate_{t-1} + \sum_{j=2}^{n} \beta_j X_{i,t-1} + FE + \varepsilon_{i,t}\,, (6)$$

where *MLP Shares*$_{i,t}$ is the natural log of the number of MLP-linked ETN shares held by fund *i* in month *t*. *Risk Free Rate*$_{t-1}$ data are obtained from Kenneth R. French's data library.[7] Control variables are defined as in Eq. (5).

Like our tail-risk hedging analysis, we estimate Eq. (6) for several subsamples of mutual funds to better understand any links between interest rates and the preference for MLP-linked ETNs. We first estimate the model for both ETN-holding funds and our matched sample of non-ETN-holding funds. We then estimate the model for only ETN-holding funds to examine if demand for MLP-linked ETNs is stronger for fund periods when interest rates are low. Next, we estimate the model for mutual funds that have ever held an MLP ETN. Given that a fund at some point will elect to hold an MLP ETN, this test allows us to determine if the timing of the MLP ETN holding is associated with interest rate levels. Lastly, we restrict the sample to income funds that have used MLP ETNs, as these funds have explicit goals for maximizing dividend income and feature prominently in the results of Jiang and Sun (2015).[8] Rejection of the null for

[7] See http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.
[8] We classify income funds as those that have four-digit CRSP objective codes equal to Equity Domestic Style Income (EDYI) or Equity Domestic Style Growth and Income (EDYB)

H_3 would imply a negative and significant coefficient estimate on the term for interest rates in each of the specifications, and would be consistent with increased mutual fund portfolio allocations toward MLP-linked ETNs in low interest rate environments.

3.7 *Modeling the use of ETNs to avoid derivatives constraints*

With our matched sample of ETN-user and non-ETN-user mutual funds, we employ two conditional logistic regression models to examine how mutual funds invest in ETNs with constraints present. Because some of our variables display only a small amount of variation over time, we estimate both a pure cross-sectional model and a panel model. The cross-sectional model is

$$MF\ Holds_i = \beta_1 Member\ of\ Family_i + \beta_2 Family\ TNA_i + \beta_3 Fund\ Age_i + \beta_4 Team\ Managed_i + \beta_5 Load\ Fee_i + \beta_6 Turnover_i + \sum_{j=7}^{n} \beta_j X_i + FE + \varepsilon_i, . (7)$$

We estimate Eq. (7) for a sample that includes both ETN-holding mutual funds and the matched sample of non-ETN-holding mutual funds. The binary dependent variable, *MF Holds*$_i$, is set to one if mutual fund *i* holds an ETN at any point over our sample period and zero otherwise. Variables of interest include those that Almazan et al. (2004) find to explain mutual fund constraints: *Member of family*$_i$ is an indicator variable equal to one if the mutual fund is part of a fund family and zero otherwise. *Family TNA*$_i$ is the log of total net assets of the fund's family, averaged over the sample period. *Fund Age*$_i$ is the log of the mutual fund's average age. *Team Managed*$_i$ is an indicator variable equal to one if the mutual fund is team-managed and zero otherwise. *Load Fee*$_i$ is an indicator variable that takes on a value of one if any of the

mutual fund share classes charge a load fee and zero otherwise. $Turnover_i$ is the average percent turnover the mutual fund experiences over the sample period. Almazan et al. (2004) find that older mutual funds, team-managed mutual funds, mutual funds that charge load fees, funds that are members of smaller families, and funds with lower turnover are more likely to face constraints. These relationships are consistent with the association between constraints and mutual funds with less oversight and accountability, as well as with mutual funds with low transaction or turnover costs.

Control variables in Eq. (7) include *Fund Size,* defined as the natural log of mutual fund total net assets averaged over our sample period. *Expense Ratio* is the average expense ratio, in percent, charged by the mutual fund over our sample period. *Cash Held* is the average percent cash held by the mutual fund over our sample period. *Family Owns ETN* is an indicator variable that takes on a value of one if a mutual fund's family holds an additional ETN and zero otherwise. *FE* represents objective fixed effects.

In addition to the pure cross-sectional model, we estimate a panel model:

$$MF\ Holds_{i,t} = \beta_1 Member\ of\ family_{i,t-1} + \beta_2 Family\ TNA_{i,t-1} + \beta_3 Fund\ Age_{i,t-1} + \beta_4 Team\ Managed_{i,t-1} + \beta_5 Load\ Fee_{i,t-1} + \beta_6 Turnover_{i,t-1} + \sum_{j=7}^{n} \beta_j X_{i,t-1} + FE + \varepsilon_{i,t}, \quad (8)$$

with error terms clustered by mutual fund. For this model, our sample contains only those funds that have held an ETN, and thus compares the periods an ETN is held to the periods an ETN is not held.

In Eq. (8), $MF\ Holds_{i,t}$ takes a value of one in months that mutual fund *i* holds an ETN and zero otherwise. We define all variables as in Eq. (7) and calculate their values as of month *t-1* rather than as a lifetime average.[9] Motivated by the work of Koski and Pointiff (1999), we add performance and risk measures to determine if characteristics are similar between ETN-user and non-ETN-user mutual funds. *Returns* are the mutual fund's monthly returns. *Volatility* is the average standard deviation of mutual fund daily returns over a month. *FE* represents objective and year fixed effects.

If constrained mutual funds are more likely to take advantage of ETNs, the coefficients on $Member\ of\ family_{i,t-1}$, $Family\ TNA_{i,t-1}$, and $Turnover_{i,t-1}$ should be negative and the coefficients on $Age_{i,t-1}$, $Team_{i,t-1}$, and $Load_{i,t-1}$ should be positive. Such findings would be consistent with high-constraint mutual funds using ETNs to circumvent constraints. Moreover, constraints should be most relevant for the holdings of derivative-like ETNs. We therefore estimate Eqs. (7) and (8) with the *MF Holds* variable computed for all ETNs and then separately for only derivative-like ETNs.

3.8 Measuring the skill of mutual fund managers when short selling ETNs

To estimate the skill of mutual funds in forecasting security returns when short selling, we create a model similar to Eq. (3). We look at the aggregate skill of mutual funds, except with a focus on short positions. In this model, we focus on the number of shares held short (*ETN Shares Held Short*) as the independent variable:

[9] If a mutual fund is launched during the month in which the fund reports holding an ETN, we retain the first month of data as the period of interest. There are five observations for which this occurs, and results are robust to dropping these observations.

$$ETN\ Return_{i,t} = \alpha + \beta_1 ETN\ Shares\ Held\ Short_{i,t-1} + \sum_{j=2}^{n} \beta_j X_{i,t-1} + FE + \varepsilon_{i,t}\,. (9)$$

Rejection of the null for H_5 requires a significant negative coefficient estimate for *ETN Shares Held Short*$_{i,t-1}$, measured as

$$ETN\ Shares\ Held\ Short_{i,t-1} = \frac{\sum_{m=1}^{M} shares\ short\ of\ ETN\ i\ by\ fund\ m\ at\ time\ t}{shares\ outstanding\ of\ ETN\ i\ at\ time\ t}, (10)$$

which would imply that mutual funds' short positions in ETNs are associated with a subsequent decline in ETN values.

With our sample of ETN data, a unique opportunity presents itself. Because our data include inverse ETNs, we can test whether any skill that fund managers have in forecasting negative returns is associated with an ability for downside forecasting in general, or within the specialized settings of the short-sales market. To examine this, we reestimate Eq. (9), replacing *ETN Shares Held Short*$_{i,t-1}$ with *Inverse Shares*$_{i,t-1}$ to capture the number of shares held long by mutual funds in inverse ETN *i* during period *t-1*. The existence of skill at forecasting negative returns in general would imply a negative coefficient estimate on *ETN Shares Held Short*$_{i,t-1}$ and a positive coefficient estimate on *Inverse Shares*$_{i,t-1}$. In contrast, if the unique capacity-constraining mechanics of short selling are associated with skilled forecasts by fund managers, then we expect a significant negative coefficient for *ETN Shares Held Short*$_{i,t-1}$ and no significant positive coefficient on *Inverse Shares*$_{i,t-1}$.

4. Results

4.1 General characteristics of ETNs held by mutual funds

Table 1 provides descriptive statistics of ETNs and ETN-month observations in which ETNs are held and are not held by mutual funds. Consistent with the stock preferences of mutual funds highlighted in Falkenstein (1996), univariate statistics show that funds prefer liquid ETNs that are larger, older, higher-priced, and have lower expenses. The ETN-month observations in Panel C indicate that outperformance of ETNs does not drive fund allocation decisions, as ETN-month observations have significantly lower average returns when the ETNs are held by funds than when ETNs are not held.

Table 3 extends our analysis of the basic characteristics of ETNs held by mutual funds to a multivariate panel regression. We evaluate the ETN-month characteristics associated with funds' decisions to hold ETNs in certain periods. Column 1 presents the estimates for the full sample of ETNs. Columns 2 and 3 present the estimates for the subsample of ETNs ever held by a mutual fund, where we measure *Returns* in Column (3) at time *t*.

[Insert Table 3 about here]

We observe no evidence that funds time their ETN holdings based on past returns, as both the level and the volatility of past returns are unrelated to ETN holdings. Some evidence does exist that funds time their holdings based on recent patterns in liquidity, with more concentrated holdings in periods when ETNs are higher-priced. Overall, the basic pattern in past returns and liquidity provide an incomplete explanation for when and why funds hold ETNs.

4.2 The skill of mutual fund managers when investing in ETNs

Panel C of Table 1 shows that both market returns and indicative value returns are significantly lower for ETN-month observations when the ETN is held by a mutual fund than for ETN-month observations when the ETN is not held by a fund. The estimates reported in Table 4 allow us to test the hypothesis (H_1) that mutual funds hold ETNs based on successful forecasts of future ETN returns while correcting for additional variables in the context of a multivariate regression. If mutual funds, as a group, increase portfolio allocations to ETNs prior to positive ETN returns, we should observe a significant positive coefficient on *ETN Shares Held*, which captures the proportion of ETN shares held long by mutual funds. However, instead of a significant positive coefficient estimate, we obtain significant negative coefficient estimates in all specifications of our model. Therefore, our data suggest that mutual funds' ETN holdings are associated with lower future ETN returns. This result is contrary to the hypothesis that fund managers select ETNs based on simple forecasts of next-period returns and suggests that additional explanations may be required to account for fund portfolio allocations to ETNs.

[Insert Table 4 about here]

4.3 Characteristics of ETN indices held by mutual funds

We present the results of modeling the association of ETN index characteristics with the probability of a fund holding an ETN in Table 5. Given that a fund holds an ETN, we examine the association between ETN index characteristics and mutual fund portfolio allocation decisions. Indices based on MLPs or derivative-like securities are positively and significantly

associated with a greater probability of being held by a fund. We can therefore make an initial rejection of the null hypotheses H_3 and H_{4A}.

[Insert Table 5 about here]

Overall fund portfolio allocations toward ETNs seem consistent with broad motivations to chase dividend yields and to gain access to derivative-like return patterns that funds may otherwise be constrained from holding. We also observe (weaker) evidence that funds prefer moderately levered (200%), but not extremely levered (300%), ETNs.

4.4 Use of ETNs for tail-risk hedging

A more formal test of our tail-risk hedging hypothesis (H_2) follows from the results presented in Table 6. H_2 is based on the argument that successful tail-risk hedging should allow for a reduction of portfolio risk through investments in VIX-linked ETNs. We therefore test if holdings of VIX-linked ETNs are associated with a reduction in mutual fund portfolio risk.

[Insert Table 6 about here]

Column 1 of Table 6 associates holdings of VIX-linked ETNs with portfolio risk for fund-month observations drawn from our sample of ETN-holding and non-ETN-holding mutual funds. We obtain a significant negative coefficient estimate, indicating that portfolio risk is lower for fund-month observations when VIX ETNs are held by a fund. In Column 2, we refine our test by reestimating our model for only funds that hold ETNs. Specifically, we compare VIX ETN

holders with non–VIX ETN-holding funds. Again, we find a significant negative coefficient estimate, indicating that, of those funds that hold ETNs, portfolio risk is lower for fund-months when VIX ETNs are held. Column 3 presents estimates for a subsample restricted to VIX ETN–holding funds. This sample gives a purer time series test because it shows whether fund risk is lower during only those months when VIX ETNs are held, relative to months when the same funds do not hold VIX ETNs. Again, we obtain a significant negative coefficient estimate for *Holds VIX*, indicating that portfolio risk is lower for funds that hold VIX-linked ETNs during the months when VIX ETNs are held. In Column 4, we include all ETN-holding funds, but restrict our sample to those observations drawn from the bottom decile of market returns. We can therefore test if mutual funds use VIX ETNs in a manner consistent with the hedging of extreme left-tail risk, in the spirit of Agarwal, Ruenzi, et al. (2016). Again, we find a significant negative coefficient, with the magnitude of the coefficient estimate increasing by about 50% relative to that reported in Column 2. This finding is consistent with the portfolio risk reduction associated with VIX ETN holdings increasing in magnitude during extreme market declines.

In Column 5 of Table 6, we perform a robustness test by taking only those fund-month observations when funds did not hold VIX-linked ETNs. We then modify our *Holds VIX* indicator to equal one for any funds that hold a VIX ETN at any point during our sample period. We are therefore comparing those funds that hold VIX ETNs at some point during our sample period with those funds that never hold VIX ETNs. However, we do not include the periods of VIX ETN holdings. If funds holding VIX-linked ETNs are systematically different from non–VIX ETN holders, this test should show a significant coefficient estimate. If, however, only the VIX ETN–holding periods lead to a reduction in risk, then no significant result should be evident. We find no significant result for this test. Combining these results with our other tests,

we conclude that VIX ETN–holding funds have portfolio risk reduced only during fund-month periods associated with VIX ETN holdings. Therefore, we reject the null for H_2 and conclude that funds use VIX-linked ETNs to hedge market risk in their portfolios, especially extreme left-tail risk.

4.5 Use of ETNs to chase dividend yields

Table 7 presents the results of our analysis of how mutual funds use MLP ETNs to chase dividend yields in low interest rate environments. We note from the results in Table 5 that mutual funds are drawn to MLP-linked ETNs. We now test if the attraction of MLP-linked ETNs is associated with the level of interest rates, as in Eq. (6). If funds shift portfolio allocations to high dividend MLPs in response to low interest rates, as stated by H_3, we should observe a negative coefficient estimate on β_1, the term for interest rates.

[Insert Table 7 about here]

Column 1 of Table 7 presents estimates for the full sample of ETN-holding and non-ETN-holding funds, and Column 2 repeats the estimation for our sample of ETN-holding funds. We obtain a significant negative coefficient for interest rates in both models. This result is consistent with greater preferences by funds for MLP-linked ETNs during those fund-months that follow periods of low interest rates. In Column 3, we restrict the sample to those funds that have held MLP-linked ETNs, and obtain a significant negative estimate of much larger magnitude. This is consistent with a preference by funds for MLP-linked ETNs in months when interest rates are lowest. In Column 4, we limit the sample to those income-oriented funds that

should have the strongest preference for high dividend yield securities in low-rate environments. Again, we find a highly significant and negative coefficient estimate. The magnitude of the estimate is roughly twice the size of the previous model, indicating that income funds shift portfolio allocations toward MLP-linked ETNs to a greater extent than other funds when interest rates are lowest. Taken together, our results provide a strong justification to reject the null hypothesis (H_3) of no association between MLP ETN allocations and interest rates. Our findings are more consistent with fund managers actively seeking out high dividend yield MLP ETNs when interest rates are low, consistent with the model of Jiang and Sun (2015).

4.6 Evidence related to the avoidance of derivative constraints by mutual funds

The results presented in Table 5 allow for an initial test of the hypothesis (H_{4A}) that mutual funds may use ETNs to circumvent constraints on derivative holdings. Table 5 shows a significant positive association between derivative-like characteristics of ETNs and preferences for these ETNs by mutual funds. We thus conclude that derivative-like characteristics of ETNs are a relevant factor in explaining the cross-sectional popularity of individual ETNs.

We now examine the cross-sectional characteristics of mutual funds that choose to hold ETNs. H_{4B} states that constrained mutual funds are more likely to hold ETNs as a means to bypass those constraints. If constrained mutual funds are more likely to take advantage of the structure of ETNs, the coefficients on *Member of family*, *Family TNA,* and *Turnover* should be negative and the coefficients on *Age*, *Team,* and *Load* should be positive. Columns 1 and 2 of Table 8 include the full matched sample of mutual funds, and Columns 3, 4, 5, and 6 include the subsample of only mutual funds that have held an ETN. The dependent variable for the cross-sectional regression in Columns 1 and 2, *MF Holds*, is equal to one if a mutual fund has ever

held an ETN and zero otherwise. In Columns 4 and 5, *MF Holds* equals one for the periods when the mutual fund held the ETN and zero otherwise. Columns 3 and 6 focus on derivative-like ETNs and, as such, *MF Holds* equals one when the mutual fund held a derivative-like ETN and zero otherwise.

[Insert Table 8 about here]

Table 8 provides inconclusive results concerning the association between mutual fund constraints and funds' holdings of ETNs. Consistent with greater derivative-like ETN use by constrained funds, we find significant negative coefficient estimates on *Member of family* and for *Family TNA*. These findings are consistent with family-based constraints driving funds toward derivative-like ETNs. However, no evidence exists that fund-based proxies for constraints are associated with increased ETN usage. The signs and significance levels are mixed for *Turnover* across models. Older funds and load funds are less likely to use derivative-like ETNs whereas binding constraints would imply a positive association between age, loads, and ETN usage. Even though our results indicate that family-level constraints are associated with increased derivative-like ETN usage, the evidence is not strong enough to clearly reject our null hypothesis (H_{4B}) of no association between mutual fund constraints and mutual fund ETN holdings.

4.7 Evidence of skill by mutual fund managers when short selling ETNs

Table 9 presents the results of our tests of how ETN short positions are associated with skill by mutual funds in forecasting ETN returns. While numerous nonreturn-based factors can encourage fund managers to take long positions in ETNs, the greater costs and risks associated

with short selling make skilled forecasts more important when taking short positions. The first three columns of Table 9 offer strong and consistent evidence of a negative association between short positions in ETNs and future ETN returns, indicating that mutual funds allocate portfolio positions in a manner consistent with the ability to accurately forecast future negative ETN returns. We can therefore reject the null hypothesis (H_5) of no association between ETN short positions and subsequent ETN returns in favor of the existence of downside forecasting skill by fund managers.

[Insert Table 9 about here]

We perform one additional test to ascertain if mutual funds' downside forecasting skill is generalizable to long positions in inverse ETNs, or if it is limited to the unique mechanics of the short-sales market. In this specification (Column 4), we replace short positions in ETNs with a variable capturing long positions in inverse ETNs. The insignificant coefficient estimate on *ETN Shares Held* shows no evidence of forecasting ability by fund managers. This result also alleviates the concern that mutual fund holdings of inverse ETNs are somehow causing subsequent negative returns. Instead, the results show that return forecasting ability is restricted to the setting of the short-sales market. This finding is consistent with what is known for short sales of equities (Chen et al., 2013): the existence of skilled forecasting by fund managers is limited to short sales and is not evident in long positions.

5. Conclusions

ETNs provide a unique security design that allows us to test several security characteristics associated with mutual fund portfolio allocations. We show that the unique structure of ETNs permits funds to access return profiles that lead to more efficient hedging, higher dividend yields, and opportunities for informed short trading.

Our initial tests find that mutual funds display poor selection ability when taking long positions in ETNs. However, once we examine more specialized considerations for ETN risk-return profiles, the choices of fund managers to hold ETNs appear more rational. We document three characteristics of ETNs that are significantly associated with fund portfolio allocation decisions under certain conditions: the ability to hedge tail-risk during extreme markets; high dividend yields during periods of low interest rates; and opportunities for skilled trades in the short-sale market. The low returns that mutual funds receive on their long ETN positions may be considered a reasonable price to pay for access to securities that allow for more specialized risk-return patterns.

We show how innovations in security design represent a response to demand for various return characteristics arising from different investment settings. Our analysis demonstrates how the motivations of portfolio managers can be complex and are unable to be explained by simple return maximization. Future research can build on these findings to further our understanding of the motivations that drive portfolio management and security design.

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Table 1
Sample descriptive statistics

Panel A provides the mean values, standard deviations, and statistical differences for the cross-sectional ETN variables, by user group. *Expense Ratio* is the average expense ratio charged by an ETN. *ETN Size* is the ETN market capitalization, averaged over our sample period. *Age* is the ETN's average age. *Volume* is the number of shares traded each day, averaged over the sample period. *Premium/Discount* is calculated as the difference between the ETN's price and net asset value, divided by price. *Price* is measured as the average price an ETN trades at over our sample period. Panel B provides the proportion of each ETN index type held by mutual funds and not held by mutual funds. Panel C focuses on the subsample of ETNs that were ever held by a mutual fund (90 ETNs) and provides the mean values, standard deviations, and statistical differences for the time-series ETN variables observed as monthly observations, comparing periods that the ETNs were held to periods they were not held. *Indicative Value Risk* is the standard deviation of daily indicative value returns for an ETN over a month. *Risk of ETN* is the standard deviation of daily market returns for an ETN over a month. *Indicative Value Return* is the average monthly indicative value return for a given ETN and *ETN Return* is the average monthly market return for a given ETN. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: ETN Characteristics

	ETN Held by Mutual Fund (N = 90)		ETN Not Held by Mutual Fund (N = 180)		Difference
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean
Expense Ratio (percent)	0.785	0.213	0.860	0.316	-0.075**
ETN Size (millions)	429.974	1,928.673	16.760	30.798	413.214**
Age (years)	3.003	1.109	1.865	1.207	1.138***
Volume (thousands)	531.835	2,235.885	14.135	38.345	517.700**
Premium/Discount (percent)	3.513	16.788	1.993	12.195	1.519
Price ($ USD)	68.027	155.606	53.076	124.823	14.952

Panel B: Proportion of ETN type held by mutual funds

	ETN Held by Mutual Fund (N = 90)	ETN Not Held by Mutual Fund (N = 180)
Variable	Proportion of Total	Proportion of Total
VIX	42.105	57.895
MLP	57.895	42.105
Derivative-like	36.416	63.584
Leveraged 200%	40.909	59.091
Leveraged 300%	6.667	93.333
Inverse 100%	32.000	68.000
Inverse 200%	21.429	78.571
Inverse 300%	30.769	69.231

Panel C: ETN-month descriptive statistics

	Periods ETN Held (N = 2,479)		Periods ETN Not Held (N = 3,955)		Difference
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Means
ETN Size (millions)	719.577	4,279.774	195.722	4,038.139	523.85***
Age (years)	3.635	1.988	3.241	2.337	0.39***
Volume Traded (thousands)	731.777	2,847.090	153.643	1,385.997	578.13***
Indicative Value Risk (percent)	1.750	1.505	1.698	1.371	0.05
Risk of ETN (percent)	1.781	1.485	1.964	1.561	-0.18***
Indicative Value Return (percent)	-0.609	8.624	-0.176	8.543	-0.43**
ETN Return (percent)	-0.628	8.584	-0.089	8.733	-0.54**
Price ($ USD)	87.582	233.243	50.469	134.414	37.11***

Table 2
Mutual funds that hold an ETN compared to non-ETN-holding matched mutual funds

This table provides average descriptive statistics and standard deviations for ETN-user and non-ETN-user mutual funds. *Member of family* is an indicator variable equal to one if the mutual fund is part of a fund family and zero otherwise. *Family TNA* is measured as the total net assets of the fund's family, averaged over the sample period. *Mutual Fund Age* is the mutual fund's age averaged over the sample period. *Team Managed* is an indicator variable equal to one if the mutual fund is team-managed and zero otherwise. *Load* is an indicator variable that takes on the value of one if any of the mutual fund share classes charges a load fee and zero otherwise. *Turnover* is measured as the average percent turnover the mutual fund experiences over the sample period. *Mutual Fund Size* is the mutual fund's total net assets averaged over our sample period. *Expense Ratio* is measured as the average expense ratio, in percent, charged by the mutual fund over our sample period. *Cash Held* is the average percent cash held by the mutual fund over our sample period. *Returns* are measured as the average monthly returns of a mutual fund over our sample period. *Volatility* is measured as the average standard deviation of mutual fund daily returns over our sample period.

	ETN-User Mutual Fund (N = 340)		Non-ETN-User Mutual Fund (N = 340)	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
Member of Family	89.706	30.433	87.376	32.686
Family TNA (millions)	57,709.450	222,150.560	110,888.620	306,585.280
Mutual Fund Age (years)	5.306	5.946	8.990	8.567
Team Managed	37.327	48.004	32.732	46.226
Load (percent of funds charging)	61.322	47.682	57.046	49.128
Turnover (percent)	181.521	186.905	135.865	168.571
Mutual Fund Size (millions)	306.058	1,038.490	292.984	858.604
Expense Ratio (percent)	1.404	0.514	1.231	0.585
Cash Held (percent)	8.521	7.943	6.166	8.292
Returns (monthly percent)	0.136	0.998	0.412	1.020
Volatility (percent over month)	0.778	0.605	0.984	0.669

Table 3
Time series likelihood of an ETN being held

This table provides the coefficient estimates, with t-statistics in parentheses from the following multivariate regression:

$$ETN\ Shares\ Held_{i,t} = \alpha + \sum_{j=1}^{n} \beta_j X_{i,t-1} + FE + \varepsilon_{i,t}$$

where *i* is a given ETN, *t* is a given month, and the dependent variable, *ETN Shares Held*, is measured as:

$$ETN\ Shares\ Held_{i,t} = \frac{\sum_{m=1}^{M} shares\ long\ of\ ETN\ i\ by\ fund\ m\ at\ time\ t}{shares\ outstanding\ of\ ETN\ i\ at\ time\ t}.$$

Market Return is the average daily market return for a given ETN. *Market Volatility* is the standard deviation of daily market returns for an ETN. *ETN Size* is the natural log of the ETN's market capitalization. *Price* is measured as natural log of the ETN's average price. *Age* is natural log of the ETN's age. *Volume* is the number of shares traded each day standardized by the total number of shares outstanding. Independent variables are measured over the month prior (*t-1*) except for *Returns* in column (3) are measured at time *t*. Column 1 presents the estimates for the full sample of ETNs. Columns 2 and 3 present the estimates for the subsample of ETNs ever held by a mutual fund. We include objective and time fixed effects and ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Variable	1	2	3
Intercept	-0.136**	-0.171***	-0.170***
	(-2.22)	(-2.44)	(-2.43)
Market Return	-0.042	-0.073	-0.052*
	(-1.46)	(-1.63)	(-1.69)
Market Volatility	0.240	1.063*	1.090*
	(1.06)	(1.66)	(1.67)
ETN Size	0.004***	0.002	0.002
	(2.86)	(1.16)	(1.15)
Price	0.018*	0.035***	0.035***
	(1.86)	(2.43)	(2.42)
Age	0.003**	0.005	0.005
	(2.09)	(1.37)	(1.38)
Volume	0.023**	-0.004	-0.005
	(2.29)	(-0.13)	(-0.17)
Fixed Effects	Yes	Yes	Yes
Observations	14,186	6,344	6,344
R^2	0.119	0.216	0.213

Table 4
Mutual fund ability at investing in ETNs

This table provides the coefficient estimates, with t-statistics in parentheses from the following multivariate regression:

$$ETN\ Return_{i,t} = \alpha + \beta_1 ETN\ Shares\ Held_{i,t-1} + \sum_{j=2}^{n} \beta_j X_{i,t-1} + FE + \varepsilon_{i,t}$$

where the dependent variable, *ETN Return* is the monthly market return for a given ETN. The independent variable of interest, *ETN Shares Held*, is measured as:

$$ETN\ Shares\ Held_{i,t} = \frac{\sum_{m=1}^{M} shares\ long\ of\ ETN\ i\ by\ fund\ m\ at\ time\ t}{shares\ outstanding\ of\ ETN\ i\ at\ time\ t}.$$

The remaining independent variables include *Volume* as the number of shares traded each day standardized by the total number of shares outstanding. *ETN Return* is the monthly market return for a given ETN. *Volatility* is the standard deviation of daily market returns for an ETN, calculated over the month. *ETN Size* is the natural log of the ETN's market capitalization. *Price* is measured as natural log of the ETN's average price. *Age* is natural log of the ETN's age. Independent variables are measured over the month prior (*t-1*). We include objective and time fixed effects in column 3. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Variable	1	2	3
Intercept	-0.001	0.041***	0.047***
	(-1.02)	(2.48)	(2.50)
ETN Shares Held	-0.094***	-0.054***	-0.058***
	(-5.51)	(-4.39)	(-4.76)
Volume		-0.001	-0.001
		(-0.07)	(-0.04)
ETN Return		0.043**	0.031
		(2.01)	(1.38)
Volatility		-0.283**	-0.254*
		(-2.02)	(-1.73)
ETN Size		-0.001	-0.001
		(-1.18)	(-1.51)
Price		-0.005**	-0.006***
		(-2.21)	(-2.46)
Age		-0.001	0.000
		(-1.52)	(-0.05)
Fixed Effects	No	No	Yes
Observations	6,344	6,344	6,344
R^2	0.008	0.016	0.031

Table 5
ETN type and mutual fund ownership

This table provides the coefficient estimates, with chi-square statistics in parentheses from the following logistic regression:

$$ETN\ Held_i = \alpha + \sum_{j=1}^{n} \beta_j X_i + FE + \varepsilon_i$$

where *ETN Held* is an indicator variable that takes on a value of one if an ETN has ever been held by a mutual fund and zero otherwise. All independent variables are also indicator variables. *VIX* takes on a value of one if the ETN provides returns tied to the VIX index. *MLP* takes on a value of one if the ETN index is based off of Master Limited Partnerships. *Derivative-like* takes on a value of one if the ETN provides derivative-like returns. *Leveraged 200%* and *Leveraged 300%* take on a value of one if the ETN is leveraged 200% or 300%, respectively. *Inverse 100%*, *Inverse 200%*, and *Inverse 300%* take on values of one if the ETN provides inverse returns of 100%, 200%, or 300%, respectively. We include objective fixed effects in column 4. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Variable	1	2	3	4
Intercept	-1.359***	-0.612***	-1.597***	-2.216***
	(23.46)	(13.73)	(21.21)	(28.08)
VIX	0.309		0.190	0.063
	(0.39)		(0.14)	(0.01)
MLP	1.677***		1.858***	2.286***
	(9.55)		(10.57)	(13.49)
Derivative-like	0.768**		1.145***	1.025***
	(5.58)		(9.21)	(6.64)
Leveraged 200%		0.259	0.768*	1.137**
		(0.55)	(3.74)	(6.41)
Leveraged 300%		-2.027*	-1.872*	-1.800*
		(3.74)	(3.13)	(2.74)
Inverse 100%		-0.142	-0.306	0.107
		(0.10)	(0.42)	(0.05)
Inverse 200%		-0.707	-0.871	-0.735
		(1.12)	(1.63)	(1.10)
Inverse 300%		-0.199	-0.359	0.256
		(0.10)	(0.32)	(0.14)
Fixed Effects	No	No	No	Yes
Observations	270	270	270	270
R^2	0.061	0.044	0.119	0.195

Table 6
Hedging and VIX ETNs

This table provides the coefficient estimates, with t-statistics in parentheses from the following multivariate regression:

$$Standard\ Deviation_{i,t} = \alpha + \beta_1 Hold\ VIX_{i,t} + \sum_{j=2}^{n} \beta_j X_{i,t-1} + FE + \varepsilon_{i,t}$$

where the dependent variable is measured as the standard deviation of daily mutual fund *i* returns over month *t*. The independent variable of interest, *Hold VIX*, is an indicator variable that takes on a value of one if the mutual fund holds a VIX ETN during month *t* and zero otherwise. *Fund Size* is the natural log of the mutual fund's total net assets. *Fund Age* is the natural log of the mutual fund's age. *Family TNA* is the natural log of the total net assets of the fund's family. *Turnover* is measured as the percent turnover the mutual fund experiences. *Cash Held* percent of cash and cash-equivalent securities in the portfolio of fund *i*. We include objective and time fixed effects and ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively. Column 1 presents estimates for the full sample of all ETN-holding funds and matched non-ETN-holding funds. Column 2 is restricted only to ETN-holding funds. Column 3 is restricted to VIX-ETN-holding funds. Column 4 includes only ETN-holding fund observations drawn from the bottom-decile of the fund-month return distribution. Column 5 includes data for ETN-holding funds, but only in those months when they did not hold VIX-linked ETNs.

Variable	1	2	3	4	5
Intercept	0.372***	0.495***	0.462***	0.737***	0.512***
	(4.84)	(6.90)	(3.91)	(4.97)	(6.70)
Holds VIX	-0.221***	-0.145***	-0.134***	-0.238***	-0.041
	(-5.76)	(-4.99)	(-5.00)	(-2.70)	(-1.15)
Fund Size	-0.030***	-0.014	-0.001	-0.013	-0.014
	(-2.83)	(-1.40)	(-0.07)	(-0.62)	(-1.33)
Fund Age	0.094***	0.068***	0.042*	0.130***	0.071***
	(6.66)	(5.13)	(1.84)	(4.59)	(5.29)
Family TNA	-0.009*	-0.016***	-0.013*	-0.026***	-0.017***
	(-1.92)	(-3.15)	(-1.68)	(-2.41)	(-3.14)
Turnover	0.011	-0.017*	-0.009	-0.069***	-0.016*
	(1.00)	(-1.87)	(-0.67)	(-3.42)	(-1.73)
Cash Held	0.000	-0.004***	-0.004**	-0.006**	-0.004***
	(-0.13)	(-3.19)	(-2.01)	(-2.09)	(-3.22)
Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	45,758	22,859	9,001	2,120	21,649
R^2	0.315	0.375	0.306	0.432	0.376

Table 7-
Dividend-chasing in low interest rate environments with MLP ETNs

This table provides the coefficient estimates, with t-statistics in parentheses from the following multivariate regression:

$$MLP\ Shares_{i,t} = \alpha + \beta_1 Risk\ Free\ Rate_{t-1} + \sum_{j=2}^{n} \beta_j X_{i,t-1} + FE + \varepsilon_{i,t}$$

where the dependent variable, *MLP Shares*, is measured as the natural log of the number of MLP shares held by mutual fund *i* during month *t*. The independent variable of interest, *Risk Free Rate*, is measured as the risk free rate of return during month *t-1*. *Fund Size* is the natural log of the mutual fund's total net assets. *Fund Age* is the natural log of the mutual fund's age. *Family TNA* is the natural log of the total net assets of the fund's family. *Turnover* is measured as the percent turnover the mutual fund experiences. *Cash Held* percent of cash and cash-equivalent securities in the portfolio of fund *i*. We include objective and time fixed effects and ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively. Column 1 presents estimates for our full sample of ETN-holding and non-ETN-holding funds. Column 2 is restricted to only ETN-holding funds. Column 3 is only for MLP-holding funds, and Column 4 includes only income-oriented funds that have held MLP-linked ETNs.

Variable	1	2	3	4
Intercept	0.477***	0.671***	3.047	4.187
	(3.15)	(2.43)	(1.52)	(0.55)
Risk Free Rate	-0.774***	-1.282***	-8.851***	-17.582***
	(-4.19)	(-4.15)	(-4.43)	(-5.24)
Fund Size	0.024*	-0.005	-0.154	2.755***
	(1.70)	(-0.13)	(-0.53)	(4.39)
Fund Age	-0.106***	-0.088	-0.123	-2.057*
	(-2.86)	(-1.49)	(-0.41)	(-1.90)
Family TNA	-0.020*	-0.007	0.123	-0.404
	(-1.73)	(-0.27)	(0.76)	(-0.42)
Turnover	-0.042***	-0.088***	-0.666**	-3.896***
	(-3.71)	(-3.86)	(-2.12)	(-3.03)
Cash Held	-0.002	-0.004	-0.026	-0.191
	(-1.32)	(-1.01)	(-0.87)	(-1.33)
Fixed Effects	Yes	Yes	Yes	Yes
Observations	45,758	22,859	2,671	328
R^2	0.021	0.033	0.187	0.527

Table 8
Mutual fund characteristics and ETN use

Columns 1 through 3 provide the coefficient estimates, with chi-square statistics in parentheses, from the following cross-sectional logistic regression:

$$MF\ Holds_i = \beta_1 Member\ of\ Family_i + \beta_2 Family\ TNA_i + \beta_3 Fund\ Age_i + \beta_4 Team\ Managed_i + \beta_5 Load\ Fee_i + \beta_6 Turnover_i + \sum_{j=7}^{n} \beta_j X_i + FE + \varepsilon_i$$

Columns 4 to 6 provide the coefficient estimates, with chi-square statistics in parentheses, from the following logistic panel regression:

$$MF\ Holds_{i,t} = \beta_1 Member\ of\ family_{i,t-1} + \beta_2 Family\ TNA_{i,t-1} + \beta_3 Fund\ Age_{i,t-1} + \beta_4 Team\ Managed_{i,t-1} + \beta_5 Load\ Fee_{i,t-1} + \beta_6 Turnover_{i,t-1} + \sum_{j=7}^{n} \beta_j X_{i,t-1} + FE + \varepsilon_{i,t}$$

For columns 1, 2, and 3 the dependent variable, *MF Holds*, is equal to 1 if a mutual fund has ever held an ETN and 0 otherwise and for columns 4, 5 is equal to 1 for the periods that the mutual fund held the ETN and 0 otherwise. For column 6, *MF Holds*, is equal to 1 the periods that the mutual fund held a Derivative-like ETN and 0 otherwise. *Member of family* is an indicator variable equal to one if the mutual fund is part of a fund family and zero otherwise. *Family TNA* is the natural log of the total net assets of the fund's family, averaged over the sample period. *Fund Age* is the natural log of the mutual fund's age. *Team Managed* is an indicator variable equal to one if the mutual fund is team-managed and zero otherwise. *Load Fee* is an indicator variable that takes on the value of one if any of the mutual fund share classes charges a load fee and zero otherwise. *Turnover* is measured as the average percent turnover the mutual fund experiences over the sample period. *Fund Size* is the natural log of the mutual fund's total net assets. *Expense Ratio* is measured as the average expense ratio, in percent, charged by the mutual fund over our sample period. *Cash Held* is the average percent cash held by the mutual fund. *Family Owns ETN* is an indicator variable that equals 1 if any mutual fund within the family owns an ETN and 0 otherwise. *Returns* are the mutual fund's monthly returns. *Volatility* is measured as the average standard deviation of mutual fund daily returns over the month. Columns 1 and 2 include the full matched sample of mutual funds. Columns 3, 4, 5 and 6 include the subsample of only mutual funds that have held an ETN. Columns 3 and 6 focuses on derivative-like ETNs and as such, MF Holds equals 1 in the periods that the mutual fund held a derivative-like ETN and 0 otherwise. We include objective and time fixed effects and ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	Cross Sectional			Panel		
Variable	1	2	3	4	5	6
Intercept			-2.249**	-1.113***	0.084	-0.881***
			(4.59)	(139.65)	(0.32)	(34.94)
Member of Family	0.321	-1.722**	-3.070***	0.379***	-1.449***	-1.791***
	(0.59)	(6.61)	(9.28)	(32.04)	(232.91)	(326.13)
Family TNA	-0.289***	-0.376***	0.144	-0.052***	-0.169***	-0.101***
	(37.19)	(21.99)	(1.73)	(84.68)	(238.87)	(92.29)
Fund Age	-1.709***	-1.535***	0.461	-0.173***	-0.140***	-0.113***
	(60.23)	(32.03)	(2.09)	(142.45)	(40.57)	(26.66)
Team Managed	-0.059	0.204	-1.155*	-0.044	-0.112**	-0.132**
	(0.06)	(0.44)	(2.72)	(1.43)	(4.65)	(6.58)
Load Fee	0.070	0.090	0.338	-0.251***	-0.121**	-0.275***
	(0.07)	(0.06)	(0.25)	(41.91)	(4.59)	(24.62)
Turnover	0.131*	0.073	-0.017	-0.071***	-0.034**	0.093***
	(3.26)	(0.46)	(0.01)	(58.28)	(6.37)	(50.67)
Fund Size		0.361***	-0.372**		0.015	-0.033**
		(7.84)	(4.14)		(0.82)	(4.21)
Expense Ratio		66.759*	28.405		-61.385***	-49.680***
		(2.80)	(0.19)		(100.88)	(69.02)
Cash Held		0.046**	0.069**		0.010***	0.016***
		(5.18)	(4.40)		(15.27)	(38.72)
Family Owns ETN		7.194***	3.166***		4.277***	3.823***
		(39.19)	(8.95)		(4888.74)	(3611.74)
Returns					0.405	-0.389
					(0.44)	(0.41)
Volatility					-24.373***	-34.761***
					(28.15)	(55.66)
Fixed Effects	No	No	No	Yes	Yes	Yes
Observations	680	680	340	22,859	22,859	22,859
R^2	0.248	0.351	0.074	0.063	0.368	0.292

Table 9
Short selling ability

This table provides the coefficient estimates, with t-statistics in parentheses from the following multivariate regression:

$$ETN\ Return_{i,t} = \alpha + \beta_1 ETN\ Shares\ Held\ Short_{i,t-1} + \sum_{j=2}^{n} \beta_j X_{i,t-1} + FE + \varepsilon_{i,t}$$

where the dependent variable, *ETN Return*, is measured over month *t* and all independent variables are measured as of month *t-1*. *ETN Return* is the monthly market return for a given ETN. The independent variable of interest, *ETN Shares Short*, is measured as:

$$ETN\ Shares\ Held\ Short_{i,t-1} = \frac{\sum_{m=1}^{M} shares\ owned\ short\ of\ ETN\ i\ by\ fund\ m\ at\ time\ t}{shares\ outstanding\ of\ ETN\ i\ at\ time\ t}$$

where shares owned short (the numerator) is replaced with inverse ETN shares held long in column 4. The remaining independent variables include *Volume* as the number of shares traded each day standardized by the total number of shares outstanding. *ETN Return* is the average daily market return for a given ETN. *Volatility* is the standard deviation of daily market returns for an ETN. *ETN Size* is the natural log of the ETN's market capitalization. *Price* is measured as natural log of the ETN's average price. *Age* is natural log of the ETN's age. Independent variables are measured over the month prior (*t-1*). Columns 1, 2, and 3 examine ETN short positions and column 4 examines long positions in inverse ETNs. We include objective and time fixed effects in columns 3 and 4. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

	Short Positions			Inverse ETNs
Variable	1	2	3	4
Intercept	-0.003*	0.043***	0.050***	0.061
	(-1.65)	(2.38)	(2.40)	(0.82)
ETN Shares Held Short	-0.145***	-0.104***	-0.102***	0.098
	(-8.63)	(-6.10)	(-5.70)	(0.59)
Volume		0.002	0.002	0.038*
		(0.11)	(0.15)	(1.93)
ETN Return		0.043**	0.032	0.000
		(2.04)	(1.44)	(-0.01)
Volatility		-0.318**	-0.297*	-0.165
		(-2.04)	(-1.79)	(-0.55)
ETN Size		-0.001	-0.001	-0.001
		(-1.11)	(-1.43)	(-0.22)
Price		-0.006**	-0.007***	-0.007
		(-2.30)	(-2.52)	(-1.28)
Age		-0.002*	0.000	-0.007
		(-1.65)	(-0.27)	(-1.07)
Fixed Effects	No	No	Yes	Yes
Observations	6,344	6,344	6,344	1,047
R^2	0.006	0.017	0.031	0.040

Figure 1
ETNs held and not held by mutual funds, by ETN sponsor

This figure shows the total number of ETNs offered by ETN sponsors, the number of ETNs held my mutual funds by fund sponsors, and the number of ETNs not held by mutual funds by fund sponsor.

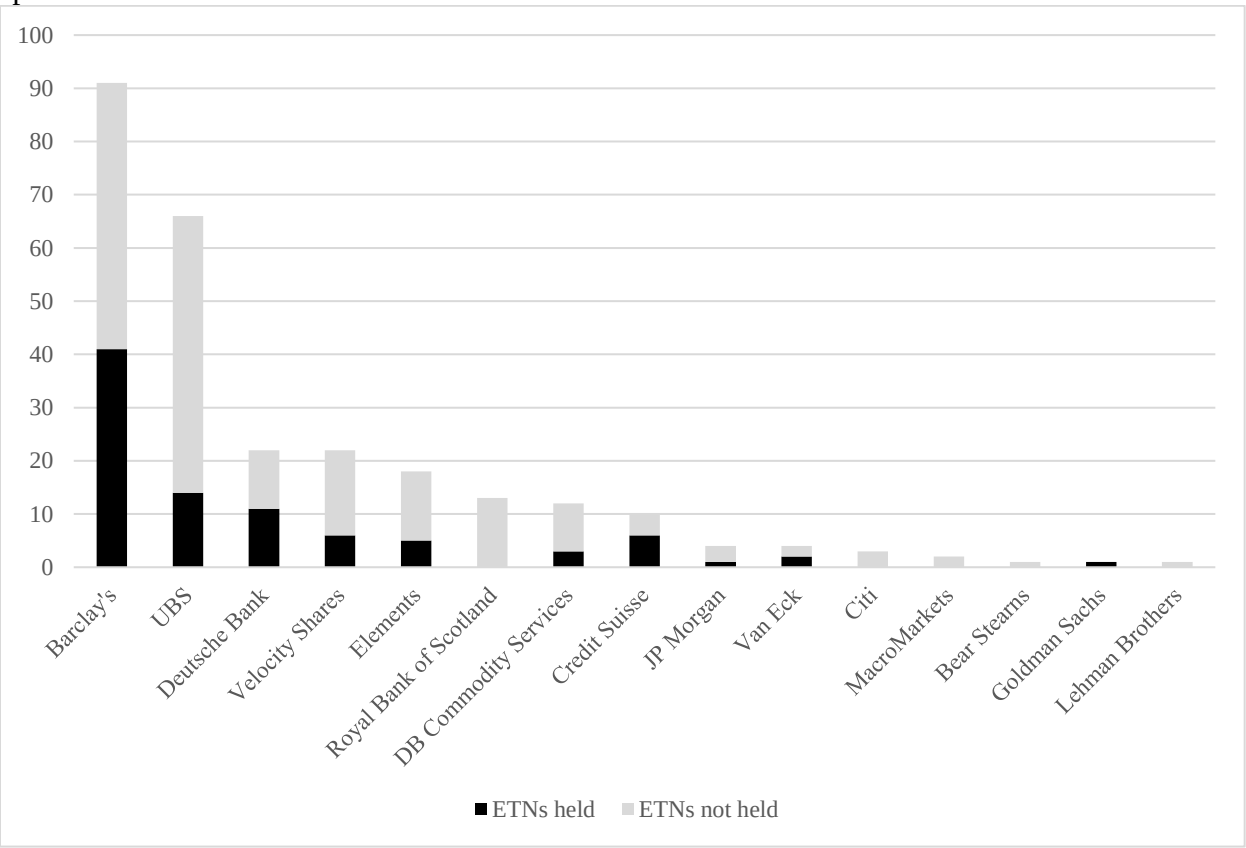
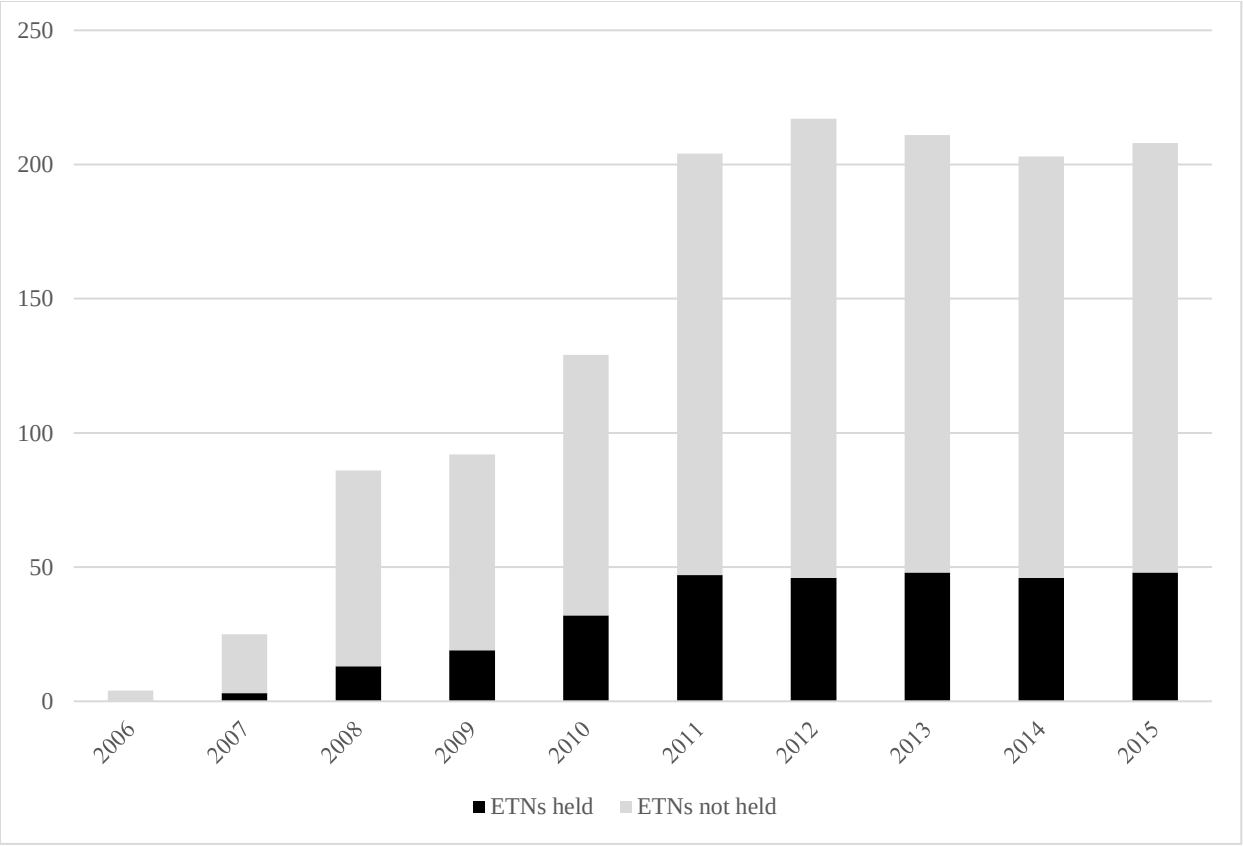


Figure 2
ETNs held and not held by mutual funds, by year

This figure shows the growth of the overall ETN market since inception. We also present the growth breakdown by total ETNs held and not held by mutual funds.



Appendix A
Table A1

This table reports the number of ETNs offered and the number of ETNs held by underlying ETN index in column (1) and the number of these ETNs that are held by mutual funds in column (2). Panel A reports the top *offered* ETNs and Panel B reports the top *held* ETNs.

Panel A: Top offered ETNs	(1)	(2)
ETN Index	ETNs Offered	ETNs Held
S&P 500 VIX Short Term Futures Excess Return	6	2
S&P 500 Total Return	6	1
Optimum Yield Agricultural Excess Returns	4	1
Optimum Yield Industrial Metals Excess Returns	4	2
Russell 1000 Growth Total Return	4	3
S&P 500 VIX Mid Term Futures Excess Return	4	1
Wells Fargo Business Development Company Price Return	4	2
Alerian MLP Index	3	2
Alerian MLP Infrastructure	3	2
Velocity Shares 3X Inverse Gold	3	3
S&P 500 VIX Mid Term Futures Total Return	3	1

Panel B: Top held ETNs		
ETN Index	ETNs Offered	ETNs Held
Russell 1000 Growth Total Return	4	3
Velocity Shares 3X Inverse Gold	3	3
S&P 500 VIX Short Term Futures Excess Return	6	2
Optimum Yield Industrial Metals Excess Returns	4	2
Wells Fargo Business Development Company Price Return	4	2
Alerian MLP Index	3	2
Alerian MLP Infrastructure	3	2
Bloomberg Commodity Total Return	2	2
Barclays 10 Year US Treasury Futures Targeted Exposure	2	2
Barclays US Treasury 2 year/10 year Yield Curve	2	2
Credit Suisse Merger Arbitrage Liquid Net	2	2
Deutsche Bank USD Inverse Japanese Gov't Bond Futures	2	2
MSCI World High Dividend Yield Gross Total Return	2	2
STOXX Europe 50 Gross Return	2	2

Table A2
Proportion of ETNs held by mutual funds by ETN objective

This table reports the number of ETNs offered and the number of ETNs held by mutual funds in our sample. We report ETN objective by CRSP mutual fund 4 digit objective codes where possible. Each successive objective code, moving from 1 to 4, represents a finer classification of ETN objectives.

ETN Objective 1	ETN Objective 2	ETN Objective 3	ETN Objective 4	Number Offered	Number Held	Proportion
Equity	Domestic	Cap-based	Large Cap	3	1	33.33%
Equity	Domestic	Cap-based	Small Cap	2	1	50.00%
Equity	Domestic	Sector	Commodities	30	3	10.00%
Equity	Domestic	Sector	Consumer Goods	1	0	0.00%
Equity	Domestic	Sector	Health	1	0	0.00%
Equity	Domestic	Sector	Industrials	4	1	25.00%
Equity	Domestic	Sector	Natural Resources	8	6	75.00%
Equity	Domestic	Sector	Technology	1	0	0.00%
Equity	Domestic	Style	Growth & Income	4	1	25.00%
Equity	Domestic	Style	Growth & Income	6	1	16.67%
Equity	Domestic	Style	Hedged	39	14	35.90%
Equity	Domestic	Style	Income	4	0	0.00%
Equity	Domestic	Style	Short	36	7	19.44%
Equity	Foreign	Regional	Emerging Markets	2	1	50.00%
Equity	Foreign	–	–	3	2	66.67%
Fixed Income	Government	Duration	Short	1	0	0.00%
Fixed Income	Foreign	–	–	1	0	0.00%
Fixed Income	Government	–	–	7	4	57.14%
Fixed Income	–	–	–	10	2	20.00%
Mixed	–	–	–	103	45	43.69%
Other	Currency	–	–	1	0	0.00%
Other	–	–	–	3	1	33.33%

Table A3
Holding characteristics by ETN objective

This table reports the characteristics of mutual fund positions in ETNs by CRSP mutual fund 3 digit objective classifications. We report cap (EDC), sector (EDS), and style (EDY) domestic equity, foreign equity (EF), regional foreign equity (EFR), sector foreign equity (EFS), income (I), income municipal (IU), mixed (M), other (O), and other currency (OC). For each objective, we report the number of ETNs held and the average portfolio holding characteristics of the ETNs held.

	Mutual Fund Objective (Mean Values by CRSP 3 Digit Objectives)										
	EDC	EDS	EDY	EF	EFR	EFS	I	IU	M	O	OC
Variable	(*N* = 5)	(*N* = 12)	(*N* = 141)	(*N* = 22)	(*N* = 22)	(*N* = 4)	(*N* = 12)	(*N* = 1)	(*N* = 90)	(*N* = 30)	(*N* = 1)
Percent of Portfolio Long	2.00	2.12	2.17	2.20	3.36	1.38	1.09	9.64	2.592	1.153	3.560
Percent of Portfolio Short	0.00	0.000	-1.01	-2.093	-1.04	0.00	0.00	0.00	-0.059	-0.107	0.000
Shares Held Long	13,279.13	65,447.12	44,464.03	65,386.25	34,594.70	15,320.13	53,505.20	10,068.18	158,698.65	66,264.43	17,000.00
Shares Held Short	0.00	0.00	-116,305.68	-4,908.33	-7,000.00	0.00	0.00	0.00	-126,92.22	-8,679.89	0.00
Market Value Held Long ($MM)	0.52	1.84	1.27	2.35	2.02	0.52	1.26	0.27	3.002	2.021	0.691
Market Value Held Short ($MM)	0.00	0.00	-2.59	-0.27	-0.26	0.00	0.00	0.00	-0.414	-0.379	0.000