ETF Loan Market: Causes and Consequences of High ETFs Lending Fees

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Abstract

We find that exchange-traded fund (ETF) lending fees are significantly higher than individual stocks. Although the create-to-lend (CTL) mechanism helps alleviate supply constraints when borrowing demand rises, its effectiveness is hampered by various costs and frictions, including the lack of competition among authorized participants (APs), hedging challenges inherent to the CTL process, and the costs and frictions associated with creating ETFs. These limitations contribute to elevated ETF lending fees (i.e., outside lending) and notably impact the stock lending market (i.e., inside lending). Specifically, increased short selling through cheaper-to-borrow ETFs can exert downward pressure on stock lending fees. Our findings highlight the constraints on arbitrage opportunities present within ETF markets.

Keywords: ETF; Lending fee; Create-to-lend; Lendable shares; Competition effect

JEL classification: G10; G11; G23

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1. Introduction

The last decade has seen a significant shift in the asset management landscape with the explosive growth of ETFs. As of the end of 2023, the ETF industry had 3,108 ETFs and assets under management (AUM) of roughly $8.1 trillion in the United States (ICI Factbook, 2024). ETFs play a significant role in financial markets, particularly equity markets, constituting more than 30% of US market trading by daily volume in the recent decade (ICI Factbook, 2024). ETFs are widely viewed as relatively inexpensive and liquid vehicles for buying a basket of stocks. In addition, a key benefit of ETFs relative to mutual funds, which contributes to their popularity, is investors' ability to borrow and short-sell these instruments. While ETFs are roughly 10% of market capitalization, they contribute to about 20% of short interest, highlighting their importance as a shorting vehicle (Wigglesworth, 2017). While the stock loan market is well understood (Chen et al., 2002; D'Avolio, 2002; Geczy et al., 2002; Cohen et al., 2007; Blocher et al., 2013; Kaplan et al., 2013; Reed, 2013; Reed, 2015), less is known about the ETF loan market, which is quite different both in its institutional details and empirical characteristics. Furthermore, despite being closely related, little is known about the interaction between the stock loan market and the ETF loan market. ETFs are baskets of underlying securities, and lenders can choose between lending the ETF security (i.e., outside lending) or individually lending its constituents (i.e., inside lending) (Markit 2017). Therefore, the ETF loan market can potentially compete with the stock loan market. Given the large and growing role of ETFs in financial markets, understanding the structure of the ETF loan market and its effect on the stock loan market is important from an academic, regulatory, and practitioner's perspective.

In the securities loan market, price (lending fee) is an endogenous outcome of the supply of lendable shares and the demand to short-sell the security (Cohen et al., 2007). It is therefore commonly viewed as a summary statistic in the securities loan market. Using data from Markit from 2006 to 2021, we find that ETF lending fees are significantly higher than stock lending fees. The median lending fee for ETFs is 350 basis points (henceforth bps), which is eight times the median lending fee for stocks at 39 bps. Further, while nearly 80% of stocks have lending fees below 100 bps, only approximately 17% of ETFs satisfy the same criteria. We also find that the average lendable share for ETFs is 2.2% of shares outstanding compared to an average of 20.0% for stocks. While more stocks are concentrated in the higher levels of lendable shares, the pattern is the opposite for ETFs. One could, therefore, argue that the higher fees are directly related to the lack of lendable shares, which is the standard relationship observed in the stock loan market. However, this argument is puzzling, given the existence of the create-to-lend (CTL) mechanism in the ETF loan market.[1]

In the case of stocks, the upper limit of lendable shares is generally determined by the shares outstanding. The actual lendable shares are then further constrained by factors such as the extent of passive ownership (Prado et al., 2016). This restricted supply in the stock loan market makes lending fees sensitive to demand fluctuations. A unique and key distinguishing feature of the ETF loan market is that, unlike stocks, new ETF shares can be created when needed to meet borrowing demand through primary market transactions — the create-to-lend (CTL) mechanism. The frictionless operation of the CTL mechanism would eliminate any shortage in ETF shares available to borrow, thereby removing the supply-side constraints in the ETF loan market. This

[1] There is another related puzzle which is trying to determine the reason for why average lendable shares are low in the ETF loan market. We address this puzzle in Bhojraj, Du and Zhao (2024). The primary finding is that, unlike stocks, ETFs are rarely owned by index funds and other passive vehicles who are generally the main lenders in the ETF market.

greater supply flexibility changes the relationship between price and quantities, where lending fees would be potentially less sensitive to demand changes. Thus, we begin by examining the relationship between demand shifts and lending fees in the ETF loan market.

While anecdotal evidence is consistent with the CTL mechanism working for the SPY ETF (e.g., Greifeld, 2020; Karmaziene and Sokolovski, 2022), we examine the efficacy of CTL using a broader sample of ETFs. We observe that an increase in short interest leads to increased lending fees for a broad sample of ETFs. However, ETF lending fees are less sensitive to short interest increases than stocks lending fees are. These results indicate that while the CTL mechanism can act as a release valve on the supply side of ETF loans to a certain degree, its effectiveness is limited. To help explain this, we then explore potential costs and frictions of the CTL mechanism.

A key factor in determining the lending fees from a CTL transaction is the composite weighted borrowing fee of the underlying securities. Typically, the lender will not engage in a CTL transaction with an ETF at a rate lower than the borrowing cost required to create the ETF basket. We find that the composite borrowing cost of the ETF constituents, together with the management fee paid to the ETF provider (henceforth composite lending fee), accounts for, on average 36.0% (median = 23.2%) of the overall ETF lending fees, still leaving about two thirds (i.e., the lending fee spread) to be explained by other factors. We identify and examine several possible frictions in the CTL process that could contribute to this spread and limit the effectiveness of the CTL mechanism.

First, we focus on the role of competition among authorized participants (APs), who are institutions that have an agreement with the ETF sponsor, which gives them the right (but not the obligation) to trade with the exchange-traded fund and create and redeem shares in the fund. They are the only institutions that can interact with the fund.[2] These institutions tend to be large self-clearing broker-dealers and play a pivotal role in the efficient trading of ETF shares as they are the ones that ensure liquidity in the secondary market of ETFs so that shares of ETFs trade close to their net asset value (NAV). We find that the lending fee spread is negatively related to the number of APs actively trading with the ETF and the trading volume of those APs, this could be because of the competition or simply the activeness of liquidity providers. Therefore, active AP intermediaries are important for the ETF lending market in reducing the lending fee.

Second, we examine the role of hedging frictions faced by CTL lenders. One significant friction arises from the lenders' risks when they cannot effectively borrow all ETF constituents. Consistent with this risk, we find that the number of ETF constituent securities with missing borrowing data in Markit is positively associated with the ETF lending fee spread. Further, this hedging risk varies based on these constituents' market trading characteristics: the ETF lending fee spread is higher for ETFs whose missing constituents have higher volatility. These results indicate the role of hedging friction in contributing to the high ETF lending fees.

Finally, we consider two unique institutional features of the ETF creation process. We start with creation fees that are charged when ETFs are created. We find a robust positive association between ETF creation fees and the ETF lending fee spread. Then, we focus on the fact that ETFs are usually issued in creation units ranging from 10,000 to 100,000 shares. In cases where the borrowing size is less than a creation unit and cannot be met by lendable inventory, the ETF lender who creates ETF shares will have to either find other borrowers to absorb the remaining shares or carry the remaining shares on their balance sheet until they find a buyer or borrower. We find that

[2] APs can trade on behalf of other market makers (especially smaller ones) as described in Du 2024, but this primarily occurs more in the illiquid asset markets such as corporate bonds. Also, the number of APs in an ETFs primary market can be viewed as a proxy for how many market makers they have in their network as market makers typically utilize the same AP to make trades.

the ETF lending fee spread is decreasing in the average borrowing size, confirming that a larger borrowing size makes it easier for the lender to turn to the CTL mechanism and reduces the lender's CTL risk.

Our results show that costs and frictions in the Create-to-lend (CTL) mechanism keep ETF lending fees elevated. The question is whether there is a cost to elevated ETF fees. One potential downside is the effect of these elevated fees on the stock loan market of the underlying securities. As baskets of underlying securities, ETF prices and trading of ETFs are closely related to the prices and trading of the underlying securities. In most cases, they are an efficient and cheap way of trading the underlying basket, either long or short. Therefore, an important implication of such costs and frictions that lead to high ETF lending fees (i.e., outside lending) is the competition effect on the stock lending market (i.e., inside lending). We investigate whether and how ETF lending activities and the lending fees affect the lending fees of the stock constituents of those ETFs.

We carry out the analysis at the stock level. First, we establish that the ETF-based short interest ratio (i.e., the aggregate dollar value of short interest across ETFs that hold a particular stock divided by that stock's market capitalization) is negatively associated with future stock lending fees, suggesting the existence of a competition effect. In other words, higher synthetic shorting (and therefore lending) of a stock through ETFs puts pressure on the lenders of that stock, causing a lower stock lending fee.

As competition is more likely to impact the stock lending market when ETFs are relatively cheap to borrow, we categorize ETFs into quintiles based on their borrowing costs, focusing on the difference between cheap and expensive ETFs. We find that the negative relation between ETF-based short interest and future stock lending fees only exists for the cheap-to-lend ETF-based short interest but not for the expensive-to-lend ETF-based short interest. This finding supports the competition effect hypothesis and suggests that cost-effective borrowing options through ETFs drive shifts in the stock lending market.

Finally, we find that the competition effect results are stronger for stocks with higher lending fees, and our inferences remain the same when we use the ETF lending fee spread (rather than the ETF lending fee itself) to define cheap versus expensive-to-lend ETFs. Taken together, these results show that ETF borrowing costs have a significant spillover effect on stock borrowing costs and, therefore, the importance of ensuring a robust ETF loan market.

This paper enhances our understanding of the ETF loan market.[3] We highlight the role of the CTL mechanism as a unique feature in the ETF loan market. We identify and evaluate the costs and frictions in its implementation. Huang et al. (2020) find that the high shorting costs of industry ETFs hinder their hedging role. Therefore, understanding the reasons for the high lending fees are essential for evaluating the efficacy of ETFs in facilitating arbitrage. The costs and frictions inherent in the CTL mechanism induce higher ETF lending fees, limiting arbitrage opportunities in the ETF market.

This paper also adds to the growing stream of work examining the role of ETFs in financial markets. Several studies examine the impact of ETFs on the volatility, comovement, liquidity, and spreads of the constituents (Leippold et al., 2016; Israeli et al., 2017; Ben-David et al., 2018; Da and Shive, 2018). Glosten et al. (2020) find that ETFs improve the contemporaneous price-earnings relationship, especially among firms in poor information environments. Huang et al. (2020) and Bhojraj et al. (2020) find that industry ETFs behave differently from more broad-based ETFs and facilitate greater market efficiency. When assessing the overall impact of ETFs in financial markets, it is important to consider that ETFs play a significant role in the short side. Our

[2] Relatedly, prior researchers have described the loan markets for stocks (D'Avolio, 2002; Geczy et al., 2002) and for bonds (Asquith et al. 2013).

paper contributes to this body of work by providing insights into the constraints of using ETFs as a short-selling device.

Finally, our results highlight the competitive nature of the ETF and stock loan markets. Given that ETFs are composites of the underlying stocks, the two lending markets should be closely interrelated. Our findings indicate that an effective loan market for an ETF has a favorable impact on the lending market of its constituents.

2. Institutional background

2.1 Mechanics of the ETF lending market

ETFs are investment companies classified as open-ended companies or unit investment trusts (UITs). An ETF is created by a sponsor, who chooses the investment objective, the benchmark, and the weighting mechanisms. Intermediaries known as Authorized Participants (APs) are the only entities allowed to interact with the fund to create or redeem ETFs. APs are usually well-known brokerage firms and banks. ETF creation takes place when an AP deposits the underlying constituents as determined by the fund manager (known as the creation basket where the information is provided daily) and in exchange receives ETF shares. Redemption is the reverse of this process. This approach ensures that there is always an additional supply of ETF shares available if demand exceeds the supply of existing shares or vice versa. This creation and redemption occur in creating units, each of which varies between 10,000 and 100,000 ETF shares.

The process for borrowing and short-selling ETFs is similar to that for stocks. Investors who would like to borrow the ETF have to locate it before they short-sell it. The demand side is originated by investors who are interested in hedging their long positions or would like to trade on information they possess (e.g., Huang et al., 2020). There are two possible sources of supply of shares in the ETF loan market: existing lendable inventory and the CTL mechanism.[4]

The lending fee is the clearing mechanism that balances out the demand for borrowing and the supply of lendable shares in the securities lending market (Cohen et al., 2007; Blocher et al., 2013). When the supply is limited, greater short-selling demand raises the lending fees. For both stocks and ETFs, the primary source of lendable shares is the shares made available by existing owners. When there is an excess supply of lendable shares, the lending fee is set by the competitive forces between the lenders. The lending fee could start from the general collateral rate when there are plenty of lendable shares and then go higher. However, in the case of ETFs, the CTL mechanism ensures that in most cases, at least theoretically, there should be fewer constraints on the supply of shares in the ETF loan market. This suggests that unlike the stock lending fee, the ETF lending fee should be less sensitive to ETF borrowing demand shifts. Further, to the extent that APs have the ability to create additional ETF shares to ensure a competitive environment, the lending fee should not be significantly greater than the composite borrowing cost for the underlying securities absent other frictions, provided there is sufficient demand to meet the ETF creation unit minimum threshold. Otherwise, investors can simply choose to short the individual securities instead of the ETF. Therefore, the floor for the lending fee when there is an excess of lendable shares is the general collateral rate and the ceiling is set by the costs and frictions of the CTL mechanism.

[4] There is a potential, additional source of transitory supply of ETFs (usually for two to three of days). The lender can choose to sell ETF shares that are not created to meet demand and wait until later to go through the creation process. This is referred to as operational shorting and is allowed under Rule 204, which provides an exemption from the SEC delivery requirements under certain circumstances. Evans et al. (2021) find that operational shorting is driven by a higher liquidity mismatch between the ETF and the underlying constituents and the presence of efficient hedges.

2.2 Create-to-lend mechanism

Normally, a low level of lendable ETF shares indicates that the lending fees would be high as in the case of stocks. However, an important difference between the ETF loan and the stock loan markets is the CTL mechanism. Unlike stocks whose supply of lendable shares is limited to the existing shares in the secondary market, ETF borrowing demand can be met through existing lendable shares as well as by the CTL mechanism through primary market transactions. For example, Karmaziene and Sokolovski (2022) provide evidence that the CTL process worked in SPY when short-sellers circumvented the short-selling ban in 2008. More recently, Greifeld (2020) shows that $9 billion in SPY shares were created in one week in March 2020 for the purpose of lending.

When a lender is unable to locate ETF shares to lend from the existing inventory, she can borrow the shares of the underlying constituents and deliver them to the ETF sponsor in exchange for ETF shares. These newly issued ETF shares are then lent to the short-seller. This mechanism creates several costs and frictions in the process.

- First, the lender has to borrow the entire creation basket and therefore faces ongoing borrowing costs, which are the weighted borrowing costs of the creation basket.[5]
- Second, the lender has to pay management fees to the ETF sponsor, but can compensate for this cost by charging borrowers higher lending fees.
- Third, the lender faces volatility risk when there are shares that cannot be borrowed. This is because the ETF has holdings in all the underlying assets, but the hedge is only available on the shares that can be borrowed. For all other constituents the lender is either unhedged or will have to find alternative means of hedging.
- Fourth, the lender faces the re-call risk from the stock lenders in any of the underlying securities because of corporate events or lendable shares that may dry up. In the event of a buy-in (i.e., forced to close the short positions on the underlying securities), the lender is left unhedged in those positions.
- Fifth, to the extent that the ETF has "excluded assets" that are part of its existing holdings but are not in the creation baskets, the lender will have to find ways to hedge out the risk from those positions using other costly approaches.

[5] The reason why the lenders need to borrow the constituents is to deliver the shares needed to create new ETFs to lend. Further, they borrow rather than buy the underlying shares because (1) purchasing requires an outlay of capital and (2) it imposes additional risk by owning the underlying constituents.

- Sixth, ETFs are normally created in units of 10,000 to 100,000 ETF shares, though this can vary from as low as 1,000 shares to as high as 250,000 shares in rare instances. When the short-seller needs to borrower fewer shares, the lender will have to carry the financing costs and the balance sheet risk on the remaining shares until those can be lent in the future.

These costs and frictions make the CTL process more expensive than it might seem at first blush. The lender will determine the total costs of all these frictions and incorporate them into the lending fee. The relative importance of the different frictions varies based on the ETF and its constituents, thereby affecting the lending fee to different degrees.[6]

2.4 Rationale behind shorting ETFs

ETF shorting occurs for several reasons, including hedging industry or market risk and/or short selling based on negative information (Huang et al., 2020). Investors can isolate the idiosyncratic component of their information by buying a stock and hedging the industry/market risk through shorting ETFs or vice versa. Similarly, ETFs are used to time market movements or make industry bets. Both hedging and market timing can be carried out in the absence of ETFs by trading the underlying basket of securities individually. However, ETFs typically make the process more efficient and cost-effective. For example, institutional constraints such as limits on the number of positions that can be held by a fund could limit its ability to trade the underlying securities. In addition, ETFs are used as substitutes in the event the underlying securities are illiquid or difficult to borrow. Li and Zhu (2022) find that ETF shorting activity increases with the

[6] For example, the Renaissance IPO ETF (ticker: IPO) has a reasonable trading volume, making it relatively easy to buy and sell (roughly $18 million of volume a day). Further, in the event of excessive demand, new ETF shares can be easily created. However, the shares of this ETF are difficult to locate, borrow, and short-sell for several reasons. The shares are distributed widely among retail investors with less than 5% institutional ownership (no holding by investment companies as of September 30, 2020), resulting in low lendable shares and high lending fees (roughly 19% per annum on 12/3/2020). Normally, at this point the CTL process should kick-in to meet the borrowing demand and reduce the borrowing cost. However, it would be difficult for the CTL mechanism to kick-in for borrowing demand of less than the creation unit as the AP would face significant risk on the remaining shares. To make matters worse, on 12/3/2020 the ETF had holdings in stocks that were difficult to borrow. For example, it has a holding in CVAC, which as of that date had a lending fee of 100%. Similarly, one constituent, a Chinese ADR DADA, is on a government watch list, making it difficult to trade. The lender will thus face the risk of being exposed to volatility in these underlying instruments.

difficulty of shorting the underlying stocks. Karmaziene and Sokolovski (2022) show that ETFs were used in 2008 to circumvent the ban on shorting financial stocks. One additional advantage of shorting ETFs is that ETF loans do not have recall risk, a critical source of short-selling risk for stocks (e.g., Engelberg et al., 2018).

3. Data

We obtain security lending data from the Markit Securities Finance database (Markit). Markit collects daily securities lending data from the lending desks of over 100 institutional lenders, representing the world's largest pool of loanable equity. We are primarily interested in security-level information on lending supply, lending fees, and utilization rates.

Lending supply is defined as the number of shares that institutions are willing to lend on a given day, scaled by total shares outstanding on the same day. Our primary metric for lending fees is the "Indicative Fee," which estimates the *expected fee paid by the borrower* (e.g. a hedge fund). This fee is derived from Markit's proprietary analytics and records of "borrow costs between Agent Lenders and Prime Brokers as well as rates from hedge funds" (Markit, 2012). It has been used as the primary estimate of borrower costs in recent research (Muravyev, Pearson, and Pollet, 2018; Palia and Sokolinski, 2024; Ramachandran and Tayal, 2021). An alternative fee measure provided by the Markit is the Simple Average Fee (SAF), which averages *actual* fees by borrowers in outstanding loan contracts. However, this measure is poorly populated, even when a stock is actually shorted. Muravyev et al. (2018) discover that SAF is frequently missing, particularly for hard-to-borrow assets with high indicative fees, suggesting that SAF is vulnerable to selection bias. We employ both measurements in our tests, but we focus on the indicative fee.[7]

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[7] Markit also report a lender-side measure- Daily Cost of Borrower Scroe (DCBS) used in the previous literature (e.g. Drechsler and Drechsler (2016), Engelberg, Reed, and Ringgenberg (2018)). DCBS indicates fees *received by lenders*. It is a score ranging from 1 (low fee) to 10 (high fee) based on Markit's proprietary data. Muravyev et. al.

The utilization rate is the percentage of lendable shares that are lent out. To construct a monthly dataset at the security level, we average the daily values for each security within a month. Our sample spans from 2006 to the end of 2021, as data prior to 2006 is sparsely populated.

Our analyses focus on *common stocks* and *domestic equity ETFs.* Our sample of common stocks (i.e. share codes 10 or 11) is drawn from CRSP Monthly Stock Database. To identify domestic equity ETFs, we start with all funds classified as ETFs in the CRSP Survivor-Bias-Free Mutual Fund database (i.e. "etf_flag is equivalent to "F"). Following earlier literature (e.g., Da and Shive, 2018; Huang et al., 2020), we apply several filters to choose *domestic equity* ETFs. First, we select funds with a Lipper asset class equal to "EQ" (i.e. equity) and exclude global or international ETFs as indicated by their Lipper objective codes.[8] Next, we use fund names to further eliminate non-domestic or non-equity funds.[9] Finally, we retain ETFs that have at least 80% of the portfolio invested in US common stocks.[10]

After merging our sample of ETFs and common stocks with the monthly Markit data, we get 60,221 ETF-month and 703,134 stock-month observations with no missing lending fees from 1,093 unique ETFs and 8,387 unique stocks, respectively[11]. Figure 1 shows the number and total

(2018) finds that DCBS underestimate fees paid by borrowers, which is the focus of our analysis. Nonetheless, in untabulated analysis we find that our results are robust to employing this lender-side measure of borrowing costs.

[8] We remove funds with the following Lipper objective codes: 'CH', 'DL', 'EM', 'EU', 'GFS', 'GH', 'GIF', 'GL', 'GNR', 'GRE', 'GTK', 'GX', 'IF', 'INR', 'IRE', 'IS', 'JA', 'LT', 'PC', 'XJ', 'AGM'

[9] Specifically, we remove funds if the name includes "global," "international," or a particular non-US region/country as well as those including "commodity," "currency," "dollar," "target date," "physical," "short," "bear," "hedge," or "neutral."

[10] We use the CRSP Survivor-Bias-Free Mutual Fund and Thomson Reuters S12 database to compute the value of portfolio invested in common stocks (i.e. share code equal to 10 or 11).

[11] Our sample of 1,093 unique ETFs is similar to Ben-David et. al. (2022), but larger than those used in previous studies primarily due to a longer sample period that extends to the end of 2021 and a more comprehensive coverage in equity holdings by combining CRSP MFDB and Thomson Reuters' data (Zhu, 2020). Many studies only use Thomson Reuters for equity holding data: Israeli et al. (2017) have 443 ETFs from 2000 to 2014, Glosten et al. (2020) have 447 ETFs from 2004 to 2013, Bhojraj et al. (2020) have 487 ETFs from 2002 to 2015, and Huang et al. (2020) have 508 ETFs from 1999 to 2017. Using CRSP MFDB data, Da and Shive (2018) have 549 ETFs from 2006 to 2013. Also combining data from MFDB and Thomson Reuters, Li and Zhu (2022) have 478 ETFs from 2002 to 2013.

market capitalization (in 2006 $B) of ETFs and stocks at the end of each year in our sample. In comparison to the stock market, the ETF industry has experienced a substantial proliferation in product offerings. Over 15 years, the number of ETFs has more than septupled (from 85 in 2006 to 639 in 2021), while the number of stocks has grown by 20%. Similarly, the industry size has increased from $152 billion to $3,077 billion, representing 8% market share of the total US combined common stocks and ETFs by the end of 2021.

We supplement our sample with information from various sources. We extract ETF holdings from the CRSP Survivor-Bias-Free Mutual Fund database, and the Thomson Reuters S12 database if a certain observation is unavailable in CRSP (Zhu, 2020). We employ CRSP Monthly Stock Database to retrieve information on returns, prices, and shares outstanding of both ETFs and stocks in our sample. Accounting data, including the exchange-disclosed short interest, is provided by Compustat. Finally, we obtain institutional ownership information from Thomson Reuters 13F database.

4. Sample Statistics

4.1. Lending Market

Table 1 summarizes key indicators in the ETF and stock loan markets. The average lending fee (as measured by "*IndicativeFee*") for ETFs is 471 basis points (bps) and 281 bps for stocks. Both ETF and stock loan fees display positive skewness, with stocks exhibiting more so, as evidenced by the median lending fee of 350 bps for ETFs and 39 bps for stocks. ETF lending fees are greater than stock lending fees before the 95^{th} percentile. Our inferences remain similar if we instead focus on simple average fees (i.e., *SAF*).

Using various *IndicativeFee* buckets, Panel A of Figure 2 provides further evidence on the distribution of lending fees for ETFs and stocks. Lending fees are less than 1% in 76% of the stocks, and between 1% and 10% in 17% of the stocks. As loan fees rise, we often see a monotonic decline in the number of stocks, but also a modest increase in the proportion of stocks with high lending fees. Lending fees in excess of 10% apply to slightly more than 6% of stocks. In comparison, most ETF fees range from 1% to 10%, with 13% of ETFs having loan fees of less than 1%. Interestingly, the right extreme tail for stocks is longer than for ETFs, with a small fraction of stocks having lending fees greater than 20% but relatively few ETFs falling in that range.

The limited supply of ETFs may contribute to relatively high average lending fees.[12] The average lendable supply of ETFs is 2.18%, compared to 19.97% for stocks, and only a small number of ETFs have a large number of shares available to lend, as evidenced by 41.59% lendable supply in the 99th percentile. Panel B of Figure 2 shows that majority of stocks (~70%) have more than 10% lendable shares, whereas 70% of ETFs have a relatively low lending supply of 2% or less. However, among ETFs, the use of the available lendable shares is high. The median utilization ratio of ETFs (i.e. the ratio of short interest and the lendable shares) is 24.13%, which is triple the median utilization ratio of stocks (8.59%). Panel C of Figure 2 shows that 12% of ETFs have utilization ratio over 90%, while it is unusual for stocks to have ratios exceeding 50%. There is a mass of ETFs (stocks) that are concentrated at the lower end of the utilization ratio distribution with about 32.2% (53.2%) of the ETFs (stocks) having ratios of less than 10%.

4.1.1. ETF Fee Spread and Heterogeneity

Because ETFs are portfolios of individual securities, high ETF lending fees may in part reflect the borrowing costs of their underlying constituents. To account for this mechanical

[12] The lending supply (i.e. *Lendable*) comprises the existing stock of shares but excludes shares generated through the CTL mechanism, which are created and lent out directly.

component, we compute an ETF fee spread, defined as the ETF's lending fee minus the weighted-average lending fee of the securities held in the ETF, using portfolio weights. This spread isolates the component of ETF borrowing costs that exceeds what would be implied by the borrowing costs of the underlying holdings.

Additionally, to examine how ETF fee spreads vary across investment objectives and market roles, we compare spreads both within and across ETF categories. We adopt two complementary classification schemes. First, following Ben-David et al. (2023), we categorize ETFs into four broad categories based on their primary investment function: broad-market, sector, thematic, and leveraged or inverse ETFs, capturing differences in hedging demand, trading intensity, and short-selling usage. Second, we utilize Morningstar style classifications to differentiate ETFs with similar investment mandates and constituent characteristics, allowing us to examine heterogeneity among ETFs that are otherwise comparable in terms of size, value–growth orientation, or sector exposure.

Figure 3 presents whisker plots of ETF fee spreads, showing the 1st–99th percentiles, interquartile ranges, and medians. The figure reports fee spread distributions for the full sample, across the four-tier ETF classification, and across Morningstar style categories. ETF fee spreads are, on average, positive and economically meaningful, with a median value that is also positive across the sample. This pattern suggests that ETFs typically charge lending fees in excess of the borrowing costs of their underlying constituents, indicating the presence of an ETF-specific component in equilibrium borrowing costs beyond what is implied by the underlying securities alone.

Figure 3 also highlights a second key result: ETF fee spreads exhibit substantial heterogeneity across the cross-section. Even in the aggregate, the distribution of fee spreads is wide and right skewed, with a nontrivial fraction of ETFs exhibiting borrowing costs far above those implied by their holdings. Importantly, this dispersion persists within investment categories. Whether ETFs are grouped using broad functional classifications or more granular Morningstar investment style definitions, fee spreads display large dispersion and overlapping interquartile ranges. Thus, ETFs with similar investment objectives and constituent characteristics can exhibit markedly different fee spreads.

Overall, the distributional evidence suggests that ETF fee spreads reflect more than the aggregation of constituent borrowing costs, pointing to an important role for ETF-specific frictions—such as short-selling demand, hedging use, and limits to arbitrage—in shaping equilibrium ETF lending fees.

4.2 Security Characteristics

When comparing security characteristics, we find that the average short interest for ETFs is 4.01%, slightly lower than the 4.50% observed for stocks. Notably, ETFs exhibit fatter right tails in their distribution, with the 90th, 95th, and 99th percentiles of short interest being higher than those of stocks. However, the median short interest for ETFs is only 0.63%, about a quarter of the 2.35% median seen for stocks. Panel D of Figure 2 further illustrates that while most ETFs have lower short interest than stocks, 11% of ETFs have a short interest ratio exceeding 30%, compared to just 2.45% of stocks. These findings indicate that although most ETFs are not heavily used for shorting, there is a subset that attracts significant attention from short sellers. In terms of other characteristics, ETFs tend to have lower institutional ownership, market capitalization, idiosyncratic volatility, and alpha, but exhibit higher momentum compared to stocks.

5. Create-to-Lend Costs and Frictions

We first examine whether the CTL mechanism is, on average, effective in alleviating the supply constraint. We then study the costs and frictions of implementing the CTL mechanism, which prevent it from functioning efficiently and contribute to higher ETF lending fees.

5.1 Lending fees and demand shift

We investigate how lending fees respond to increases in shorting demand for both stocks and ETFs. In the case of stocks, lending fees would be sensitive to increases in demand as the supply is constrained. However, in the case of ETFs, if the CTL mechanism is working, new shares can be created to alleviate the supply constraints; thus, the lending fees should not be sensitive to increases in demand.

To test the above predictions, we examine the relation between changes in lending fees and the increases in short selling demand. We estimate the Equation 1 at the security-month level:

$$\Delta Fee_{i,t} = \alpha + \beta_1 \Delta SIR_{i,t} + \Delta Controls_{i,t} + \varepsilon_{i,t}, \qquad (1)$$

where $\Delta Fee_{i,t}$ is the month-over-month change in lending fees. $\Delta SIR_{i,t}$ is the monthly short interest ratio changes from the prior month. We include a battery of control variables in the form of month-over-month changes: change in previous 12-month returns (*Chg_Momentum*), change in log of market capitalization (*Chg_MCap*), change in the monthly average of the daily bid-ask spread (*Chg_Spread*), change in institutional ownership (*Chg_IO*), change in the idiosyncratic volatility (*Chg_IVol*), and change in alpha (*Chg_Alpha*).

Table 2 presents the regression results. We control for year-month fixed effects, and include the month-over-month changes of control variables in Columns 1-2. We find that $\Delta SIR_{i,t}$ has a marginally significant and negative coefficient for ETFs (Column 1: 0.002; t = 1.78), indicating that the price (i.e., lending fee) is still sensitive to demand shocks (i.e., increase in short interest). In other words, the CTL mechanism is not working *perfectly* in eliminating the supply constraint in the ETF lending market. However, this does not necessarily mean that the CTL mechanism is not working *at all*. To provide a benchmark of sensitivity between lending fees and short interest change without the CTL mechanism, we estimate Equation (1) using the sample of stocks. We find that the coefficient on $\Delta SIR_{i,t}$ is highly significantly positive (Column 2: 0.009; t = 2.62). More importantly, the coefficient for stocks is about five times as large as that for ETFs. In other words, lending fees respond to increases in demand for both stocks and ETFs. Still, the sensitivity is much weaker for ETFs, suggesting that the CTL mechanism potentially plays a role in alleviating the supply constraint in the ETF lending market in the presence of demand shocks.

5.2 Costs of borrowing constituents and management fees

While the prior subsection provides evidence on the functionality of the CTL mechanism, the degree to which this mechanism can mitigate supply constraints hinges on its associated costs and frictions. A key factor in determining the lending fees from a CTL transaction is the *composite weighted borrowing fee of the underlying securities*. Typically, the lender will not engage in a CTL transaction with an ETF at a rate lower than the borrowing cost required to create the ETF basket. To determine the *composite borrowing fee of an ETF* basket, we compute the weighted average of the lending fees for the ETF's constituents, using the loan market information of each constituent in Markit: $CompBorrowFee_{f,t} = \sum_{i=1}^{N} w_{i,t} * Fee_{i,t}$, where $CompBorrowFee_{f,t}$ is the composite borrowing fee for an ETF f in month t, $w_{i,t}$ is the weight of stock i in the portfolio at the end of month t and $Fee_{i,t}$ is the lending fee for stock i in month t. We calculate the composite borrowing fees by using both *IndicativeFee* and *SAF* as the lending fees for the underlying stocks. The ETF expense ratio is another cost incorporated into the CTL process. This expense is covered by the lender, who anticipates reimbursement from the borrower. The fundamental cost of lending, which we refer to as the composite lending fee (*CompLendFee*), is the sum of the composite borrowing fee and the expense ratio. This amount is the lender's minimum expectation from the CTL process. Any difference between the actual lending fee and the composite lending fee can be attributed to various other frictions within the CTL process, as discussed below in this section.

Table 3 provides information on the distribution of composite borrowing and lending fees associated with ETFs. The average expense ratio for ETFs is 37.7 bps, aligning closely with the median of 35 bps. We present statistics based on *IndicativeFee* at the top and based on *SAF* at the bottom, but the overall pattern is similar across the two sets of statistics. Using *IndicativeFee,* the average composite borrowing fee is 44 bps, with the median slightly lower at 38 bps. Adding the expense ratio to the composite borrowing fee results in an average composite lending fee of 82 bps and a median of 76 bps. This represents approximately 36% of the indicative fee (referred to as *Compratio* in the table), with a median value of 23%.[13] On average, two-thirds of the indicative fees remain unaccounted for by the composite borrowing rate and the expense fee alone. To further gauge the magnitude of the unexplained portion, we calculate the spread between the ETF lending fee and the composite lending fee (referred to as *LendFeeSpread*). The mean (median) spread is 375 (267) bps based on *IndicativeFee* and 343 (207) based on *SAF.* We delve into the three primary factors contributing to this spread in the subsequent sections: the competition among authorized participants (APs), hedging frictions in the create-to-lend (CTL) process, and the costs related to

[13] Note that the CompRatio exceeds 1 in approximately 7% of the ETF-month observations, indicating that the actual lending fees for these ETFs are lower than their composite lending fees. At first glance, this may seem surprising, but it can occur in a scenario where there's an abundance of lendable ETF shares coupled with a competitive lending environment. Under these circumstances, the CTL mechanism becomes irrelevant, and the lending fees are instead dictated by the competition among lenders holding ETF shares. Supporting this explanation, we observe that ETFs in this category tend to be large and liquid, with ample lendable shares available. For instance, SPY frequently appears in this group. Another contributing factor is that market makers might avoid external borrowing by utilizing their internal inventories, allowing short sellers to borrow ETFs under more favorable terms than the composite lending rate.

the creation of ETFs. To examine how various costs and frictions in the CTL process affect the lending fee spread, we estimate the following Equation 2 at the ETF-month level.

$$LendFeeSpread_{i,t} = \alpha + \beta_1 CTL\ Cost\ or\ Friction\ Proxy_{i,t} + Controls_{i,t} + \varepsilon_{i,t}. \qquad (2)$$

where $LendFeeSpread_{i,t}$ represents the lending fee spread, and *CTL Cost or Friction Proxy* refers to various proxies we discuss below capturing the competition of the AP market, the hedging frictions in the CTL process, and the costs and frictions related to ETF creation. To mitigate the impact of outliers and enhance interpretability, we transform *CTL Cost or Friction proxies* into decile ranks ranging from zero to one (i.e., with *DR_* prefix). We control a battery of characteristics in equity market and security lending market in this regression, including the cumulative return in the past 12 months (*12 M Ret*), log of market capitalization (*LnMCap*), the percentage of shares outstanding that is available for lending (*Lendable*), the percentage of lendable supply that is lent out (*Utilization*), idiosyncratic volatility (*IVol*), Fama-French three factor alpha (*Alpha*), and monthly shares turnover (*Turnover*).

5.3 Competition in the AP market

Authorized participants (APs) play a critical role in the primary market with the exclusive right to create and redeem ETF shares. They benefit from the arbitrage opportunities, enhancing the efficiency of the primary ETF market. In the ETF lending market, their role is analogous; they can borrow underlying constituents and create ETFs to lend out. However, if the market of APs is concentrated among a few players, they may leverage their position to charge high lending fees for ETFs. To assess the role of AP competition, we explore a novel dataset derived from the SEC's N-CEN filings, which provide comprehensive information about investment companies, the funds they manage, their strategies, organizational structure, and service providers.[14] This rich dataset allows us to analyze various aspects influencing a fund's operations.

We focus on gross creation and redemption volumes for ETFs by APs. For our analysis, we transform these filings into a calendar-year quarterly format based on fiscal year start and end dates of each filer. The final dataset includes filings from 274 unique fund families spanning from 2018Q1 to 2021Q2. We then construct two metrics to assess AP market competition: (1) the number of active APs with non-zero volumes (*Active AP #*), (2) the volume of AP activities as a percentage of market capitalization (*Active AP Volume*). The summary statistics of those variables are presented in the bottom of Table 3. In our sample, the mean (median) of active APs for an ETF is 9 (8), and the mean (median) of active AP trading volume is 15% (8%) of the market capitalization. This is not a perfect measure of competition in the primary market as APs can trade on behalf of other market makers. However, market makers tend to trade through the same AP, so we view each AP as a proxy for some set of market makers. Thus, if an ETF has a larger number of active APs, they are likely trading with a lot more market makers trading in the primary market.

Table 4 presents the regression results. Both the number of active APs (*DR_Active AP #*) and the volume of AP activities (*DR_Active AP Volume*) are significantly negatively associated with the ETF lending fee spreads, regardless of whether it is measured by indicative fees (Columns 1-2) or SAF (Columns 3-4). Specifically, a decile increase in the number of active APs (the volume of AP activities) is associated with a reduction of 8.7 (17.0) basis points in the ETF lending fee spread based on indicative fees (Columns 1-2). The results are quantitatively similar when we measure ETF lending fee spread based on SAF (Columns 3-4). These findings underscore that

[14] In 2016, the SEC introduced Form N-CEN for registered investment companies as part of its reporting modernization effort (along with N-PORT). The form is to be filed once a year, no later than 75 days from the close of the fiscal year for which the form is being filed.

ETFs tend to be costlier than their composite lending fees when the AP market lacks competitive dynamics, highlighting the economic significance of AP competition in the ETF lending market.

5.4 Hedging frictions in implementing CTL

The CTL process introduces hedging risks for the lender. In this setting, the lender holding a long position in the ETF must hedge by borrowing the underlying securities. To the extent there are some securities that cannot be borrowed, the lender faces inherent risk and must charge a fee to the borrower to compensate. This is different from the create-to-sell setting, where the AP creates the ETF, sells it, and exits the transaction, bearing no further risk.

Although we cannot directly observe the availability (or "locate status") of each constituent, we can proxy for it by examining how often, within a month, these constituents do not have lendable shares data in the Markit database. If an ETF has positions in hard-to-locate stocks, then other factors, such as the volatility of those shares, will matter as they will affect the tracking error between the ETF and the constituents. In anticipation of these challenges, the lender seeks compensation. To quantify the hedging frictions in implementing CTL, we develop two metrics: (1) the number of ETF constituents with any missing lending fee data in that month (*LendMiss #*), and (2) the return volatility of ETF constituents weighted by the proportion of days missing lending data (*LendMiss Volatility*). As shown in the bottom of Table 3, the mean (median) of number of ETF constituents missing lending data in the month is 1.71 (0), and the mean (median) of the weighted volatility of those missing constituents is 0.91 (0). As before, we transform these two variables into decile ranks ranging from zero to one and estimate Equation 2.

Table 5 presents the regression results on the relation between CTL hedging frictions and ETF lending fee spreads. Both coefficients of *DR_LendMiss #* and *DR_LendMiss_Volatility* are significantly positive at the 1% level, regardless of whether we measure ETF lending fee spreads based on *IndicativeFee* (Columns 1-2) or based on *SAF* (Columns 3-4). The estimates are economically significant: a one decile increase in *DR_LendMiss #* (*DR_LendMiss_Volatility*) is associated with a 6.9 (6.3) bps higher ETF lending fee spread. Overall, the results indicate that ETFs tend to incur higher costs than the composite lending fee based on constituents due to considerable frictions encountered during the CTL process.

5.5 Frictions related to the creation of ETFs

In this section, we delve into the institutional details related to the creation of ETFs. First, the creation of ETFs incurs a fee, which directly impacts the CTL mechanism. To quantify this, we create a variable, *CreateFee*, representing the creation fee obtained from the N-CEN file. Second, ETFs are created in creation units, meaning they are created in predetermined sizes. This structure presents a challenge when the demand for an ETF, as indicated by a locate request, is less than a full creation unit. In such instances, the ETF lender must source the required shares from their existing inventory or seek additional borrowers willing to take on the surplus shares of the newly created ETF. If unable to do so, the lender bears the risk on their balance sheet until a suitable borrower or buyer is found. The ETF lender requires to be compensated due to this friction caused by the small demand size. To measure the size of the borrowing demand, we use a proxy, *BorrowSize*, calculated as the monthly shares on loan divided by the monthly average daily transaction counts reported in the Markit database.[15] As shown in the bottom of Table 3, the mean (median) of borrow size is 9600.6 (1410.5), and the mean (median) of the raw creation fee is 724.7 (500). Again, we transform two variables into decile ranks ranging from zero to one and estimate Equation 2.

[15] We acknowledge that this is a crude measure of actual borrowing size, because there is a mismatch between the numerator (i.e., shares on loan, which is a stock variable measured at point of the time) and the denominator (i.e., the transaction count, which is a flow variable measured during a period).

Table 6 presents the regression results on the relation between CTL creation frictions and ETF lending fee spreads. The results suggest that the creation fee, as shown in Columns 1 and 3, has a positive and significant association with the lending fee spread. Conversely, the borrowing size has a negative and significant association with the lending fee spread. In terms of economic magnitude, a one decile increase in *CreateFee* (*BorrowSize*) is associated with more than 8.4 bps higher (13.6 bps lower) ETF lending fee spread when we measure spread by indicative fees in Columns 1-2. The economic magnitude is larger when we measure the spread by SAF in Columns 3-4. Overall, the results confirm the significant roles of ETF creation frictions in affecting ETF lending fee spreads.

6. The Competition Effect of ETF Lending Fees on Stock Lending Fees

So far, we have documented the fact that ETF lending fees are higher than composite stock lending fees in the ETF portfolio, and that costs and frictions in the Create-to-lend (CTL) mechanism explains a significant piece, though not all, of the lending fee spread. In this section, we focus on one important implication of the high ETF lending fees– the competition effect on the stock lending market. We investigate whether and how ETF lending activities and the lending fees affect the lending fees of the stock constituents of those ETFs.

6.1 "Inside" and "Outside" lending of ETFs

Like other pooled investment vehicles, ETF providers can generate additional revenue through **inside lending**, where they lend out the underlying securities held in their portfolios (Markit 2017). This practice is widely discussed in the literature, focusing on the dynamics of supply, demand, and pricing of the lent securities and the revenues derived from such activities. However, another crucial aspect of the ETF market is **outside lending**, which allows ETFs to be borrowed and shorted for various purposes, such as directional betting, hedging, or operational needs. For instance, Huang et al. (2020) illustrate that industry ETFs can be shorted to hedge against industry risk, allowing investors to focus on firm-specific information before positive earnings announcements. Their findings show significant long-short activity, where investors buy stocks while shorting ETFs, contributing to price efficiency by reducing the post-earnings announcement drift. Li and Zhu (2022) further argue that investors may short-sell ETFs as a substitute for hard-to-borrow underlying securities while taking long positions in the remaining securities to create a synthetic short position. Similarly, investors with a bearish outlook on a particular industry or the broader market can short-sell ETFs that track specific industries or market indices, leveraging the flexibility provided by both inside and outside lending mechanisms.

6.2 Outside lending of ETFs and lending fees of their stock constituents

We investigate whether the lending of ETFs (i.e., outside lending) introduces competition in the stock lending market for stock constituents of those ETFs. For example, in the absence of ETFs, an investor needing to hedge against industry risk must find and short sell a portfolio of multiple stocks within the same industry. Instead, industry ETFs can offer a more straightforward alternative for such hedging strategies. In this section, we examine if this competition effect exerts price pressure on stock lending fees. Following Li and Zhu (2022), we compute ETF-based short interest ratio for each stock (*ETF-based SIR*) in our sample. For any stock, *ETF-based SIR* is equal to the aggregate dollar value of short interest across ETFs that hold this stock divided by that stock's market capitalization.[16] In our sample, *ETF-based SIR* has a mean (median) of 7% (3.5%).

[16] For example, if Apple shares are held in 2 ETFs (ETF A and ETF B) that are shorted (i.e., they have a short interest). We calculate the weight of Apple in each ETF. We multiple the weight of Apple in ETF A by the short interest of ETF A to determine the short interest in Apple arising through ETF A. We do the same with ETF B. We sum the two short interests to arrive at the aggregate ETF driven short interest which is then scaled by the total shares outstanding in Apple.

We then investigate the relationship between this ETF-based short interest ratio and future stock lending fees using Equation 3:

$$StockFee_{i,t+1} = \alpha + \beta_1 \text{ ETF-based SIR}_{i,t} + Controls_{i,t} + \varepsilon_{i,t}. \quad (3)$$

StockFee is proxied by indicative fee or SAF. As in the prior regressions, we control for a few key lending market and stock-level characteristics, including past returns (*12MRet*), size (*LnMcap*), lendable supply (*Lendable*), utilization ratio (*Utilization*), idiosyncratic volatility (*Ivol*), Fama-French three-factor alpha (*Alpha*), number of analyst coverage (*Numest*), and stock turnover (*Turnover*). Importantly, we also control for the *current* stock lending fee to focus on the month-over-month change of lending fees. We also control for time- and industry- or firm-fixed effects and cluster the standard errors by firm and time.

Table 7, Panel A presents the results. We find that the coefficient of *ETF-based SIR* is significantly negative at the 1% level across all columns, regardless of the fixed effects structure and whether we measure stock lending fees based on indicative fees or SAF. In terms of economic significance, we find that a 1% increase in the *ETF-based SIR* is associated with a 0.74% decrease in indicative fees in Column 1 when we control for industry fixed effects. Controlling for firm fixed effect in Column 2 decreases the magnitude to 0.49%. The economic magnitude is overall about twice as large when we use SAF in Columns 3-4 as when we use indicative fee in Columns 1-2. These results suggest that increased ETF lending activity leads to lower stock loan fees. These results are consistent with the competition effect of ETF outside lending on the stock loan market.

6.3 ETFs with cheap versus expensive lending fees

ETF-based short interest in a stock is not exogenous and could be determined by the market capitalization of the stock and other underlying factors. As a result, both ETF-based short interest in a stock and its future lending fees may be driven by these underlying common factors. One alternative explanation could be that large stocks are more likely to be held by ETFs (and therefore lent out) and have low lending fees. We believe this alternative is unlikely to explain our results because we control the market cap, stock fixed effect, and the current stock lending fee. Nevertheless, to bolster the confidence in our inference, we build on one core intuition based on competition effect and conduct a within-stock analysis. Specifically, the competition effect between outside ETF lending and the stock lending market arises from the availability and relative cost of borrowing ETFs versus directly borrowing the underlying stocks. Cheap ETFs should drive this effect to borrow rather than expensive ETFs *for the same stock*. Therefore, if the negative relation between a stock's ETF-based short interest ratio and its future lending fee is caused by the competition effect of ETF outside lending, the effect should be more pronounced for comparatively inexpensive ETFs. This approach mitigates or eliminates most alternative explanations to our main finding. To explore this, we categorize ETFs into quintiles based on their indicative fees (or SAF) and denote the top 20% as expensive ETFs and the bottom 20% as cheap ETFs. We compute *ETF-based SIR* separately for these two groups and augment our regressions in Equation (3) with these two groups. Table 7, Panel B reports the regression results. We find that the short interest through ETFs that are cheap to short has a significantly negative association with the future stock lending fees, with *ETF-based SIR (Bottom 20%)* being significant at the 1% level across all four columns. In contrast, the short interest through ETFs that are expensive to short (*ETF-based SIR (Top 20%)*) is insignificant at the conventional level across three out of four columns, except marginally significant in Column 4 with a coefficient of only 1/5 of that on *ETF-based SIR (Bottom 20%)*. These results provide further support for the competition effect and help rule out any alternative explanation based on omitted correlated stock-level variables.

6.4 Supplementary analyses on the competition effect

To further corroborate our inference that outside ETF lending creates a competition effect on stock lending market, we conduct several additional sets of analyses. First, we explore the cross-sectional variation in the competition effect by focusing on the lending fee of the current stock. If it is extremely cheap to borrow the stock directly, short sellers might feel much less needed to build a synthetic short position via ETFs. By contrast, this strategy would become more economically feasible when it is expensive to borrow the current stock. As a result, we create an indicator variable (*Top_Fee*) that takes the value of 1 for stocks in the top 20% of most expensive lending fees. We then interact our *ETF-based SIR* with this indicator. Our regressions in Table 8, Panel A show that the impact of ETFs short selling activity is significantly more pronounced among those stocks with high lending fees, consistent with the implication of competition effect.

Second, we address one specific alternative explanation based on reversal causality – cheap-to-lend stocks are held by cheap-to-lend ETFs, creating a spurious negative association between cheap-to-lend ETF-based short interest ratio and future stock lending fees. It is important to note that we use a lead-lag specification, and we control the current stock lending fee as well as stock fixed effect, all of which should help mitigate this issue. Further, to alleviate any remaining concerns, we identify cheap and expensive ETFs based on the spread between the ETF lending fee and the composite lending fee, rather than the raw ETF lending fees. In other words, we explicitly remove the impact of stock lending fee in our categorization of cheap versus expensive-to-lend ETFs. Table 8, Panel B presents the results. We can find that the ETF-based short interest using ETFs with smaller spreads has a significantly negative correlation with future stock lending fees, while ETF-based short interest using ETFs with larger spreads does not show a significant relation with future stock lending fees. Taken together, our results provide a cohesive set of results supporting the competition effect of ETF outside lending on stock lending. To the extent that stock lending has major impact for market efficiency and price discovery, these results suggest that the costs and frictions of CTL have important implications for stock markets.

7. Conclusion

In this paper, we find that ETF lending fees are significantly higher than stock lending fees. This is surprising because the Create-to-lend (CTL) mechanism should provide ETFs with unlimited supply. We provide a detailed description of the create-to-lend (CTL) mechanism that is unique to ETFs. We identify the costs and frictions of implementing the CTL mechanism and examine their effects on ETF lending fees. A primary cost is the composite borrowing fee of the ETF constituents, as well as the ETF expense ratio. Together, these represent less than 40% of the ETF lending fees, leaving a substantial spread between ETF lending fees and the composite lending fees of their constituent stocks.

We examine three sets of costs and frictions that explain the ETF lending fee spread: competition among authorized participants (APs), hedging frictions, and the ETF creation process. First, APs are crucial to ETF liquidity, as they have exclusive rights to trade directly with the ETF and create or redeem shares. We find that a higher number of active APs and greater trading volume are associated with narrower lending fee spreads, indicating that AP participation reduces costs. Second, hedging frictions, such as the inability to borrow all ETF constituent securities, contribute to higher ETF lending fees. We find that ETFs with more missing constituent data or higher volatility experience wider fee spreads, highlighting the risks for lenders. Lastly, the ETF creation process itself influences lending costs. We find that ETF lending fee spread is higher for ETFs with higher creation fees and larger borrowing sizes.

We explore one specific implication of high ETF lending fees caused by the CTL costs and frictions: the competition effect on the stock lending market, where the availability of cheaper-to-borrow ETFs influences the lending fees of the underlying stocks. We find a negative relationship between ETF-based short interest ratios (*ETF-based SIR*) and future stock lending fees, particularly when ETFs are inexpensive to borrow. This suggests that investors use these cheaper ETFs as alternatives for shorting, exerting downward pressure on stock borrowing costs. The effect is more significant for stocks with higher initial lending fees. Robustness checks further confirm that this competition effect is not due to reverse causality or underlying stock characteristics, emphasizing the CTL mechanism's broader influence on stock market dynamics.

Our findings have implications for the role of ETFs in market efficiency. We present evidence of, and reasons for, a significant limit to arbitrage — very high lending fees in the ETF loan market as well as its implication for the stock loan market. High lending fees adversely affect market efficiency by triggering ETF overvaluation and hindering the hedging role of ETFs (Huang et al., 2020), and also reduce the competition benefits to the stock lending market. While the stock loan market is well understood (e.g., D'Avolio, 2002; Geczy et al., 2002), the ETF loan market is very different in its institutional details and empirical characteristics. Understanding the ETF loan market is a prerequisite when studying the use of ETFs as a short-selling device. For example, researchers who study shorting ETFs when the liquidity of the constituents is poor should carefully consider how this lack of liquidity affects the ETF lending market, the lending fees, and the CTL mechanism. Finally, the concentration of short-selling activity and low lending fees in a subset of ETFs suggest that researchers should be careful when using the entire sample of ETFs to address questions related to short-selling.

Our findings also have implications for practice. It is important for practitioners to understand the consequences of various institutional features. While the costs and frictions in the ETF loan market explain a significant part of the high lending fees, there is still a lot that remains unexplained, suggesting potential inefficiencies. This is consistent with the marketing material issued by Markit (2017) urging investors to lend their ETFs by explaining why investors should make their shares available to lend and the potential missed opportunities if they choose not to do so. Our findings can provide some guidance to practitioners, including ETF sponsors, ETF owners, lending agents, brokers, and data providers, to identify and reduce inefficiencies in the ETF lending process.

References

Asquith, P., Au, A. S., Covert, T., & Pathak, P. A. (2013). The market for borrowing corporate bonds. *Journal of Financial Economics*, *107*(1), 155-182.

Ben-David, I., Franzoni, F.A., & Moussawi, R. (2018). Do ETFs increase volatility? *The Journal of Finance*, *73*(6), 2471-2535.

Bhojraj, S., Mohanram, P., & Zhang, S. (2020). ETFs and information transfer across firms. *Journal of Accounting and Economics*, *70*(2-3), 101336.

Bhojraj, S., Du, L., & Zhao, W. (2024). ETF lending and investment company ownership. Working paper.

Blocher, J., Reed, A. V., & Van Wesep, E. D. (2013). Connecting two markets: An equilibrium framework for shorts, longs, and stock loans. *Journal of Financial Economics*, *108*(2), 302-322.

Chen, J., Hong, H., & Stein, J. C. (2002). Breadth of ownership and stock returns. *Journal of Financial Economics*, *66*(2-3), 171-205.

Cohen, L., Diether, K. B., & Malloy, C. J. (2007). Supply and demand shifts in the shorting market. *The Journal of Finance*, 62(5), 2061-2096.

D'Avolio, G. (2002). The market for borrowing stock. *Journal of Financial Economics*, *66*(2-3), 271-306.

Da, Z., & Shive, S. (2018). Exchange traded funds and asset return correlations. *European Financial Management*, *24*(1), 136-168.

Du, L. (2024). Role of Inventory in Liquidity Transformation: Evidence from Corporate Bond ETF Creations. *Working Paper.*

Engelberg, J. E., Reed, A. V., & Ringgenberg, M. C. (2018). Short-selling risk. *The Journal of Finance*, *73*(2), 755-786.

Evans, R. B., Moussawi, R., Pagano, M. S., & Sedunov, J. (2021). ETF Short Interest and Failures-to-Deliver: Naked Short-Selling or Operational Shorting? Working paper. Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2961954.

Geczy, C. C., Musto, D. K., & Reed, A. V. (2002). Stocks are special too: An analysis of the equity lending market. *Journal of Financial Economics*, *66*(2-3), 241-269.

Glosten, L., Nallareddy, S., & Zou, Y. (2021). ETF activity and informational efficiency of underlying securities. *Management Science*, *67*(1), 22-47.

Greifeld, K. (2020). JPMorgan sees shorts behind $9 billion influx into S&P ETF. Bloomberg News March 17, 2020. Available at https://www.bloomberg.com/news/articles/2020-03-17/jpmorgan-sees-short-sellers-behind-influx-of-cash-to-s-p-etf.

Huang, S., O'Hara, M., & Zhong, Z. (2021). Innovation and informed trading: Evidence from industry ETFs. *The Review of Financial Studies*, *34*(3), 1280-1316.

ICI Factbook. (2024). 2024 Investment Company Factbook. Available at https://www.ici.org/system/files/2024-05/2024_factbook.pdf.

Israeli, D., Lee, C. M., & Sridharan, S. A. (2017). Is there a dark side to exchange traded funds? An information perspective. *Review of Accounting Studies*, *22*(3), 1048-1083.

Kaplan, S. N., Moskowitz, T. J., & Sensoy, B. A. (2013). The effects of stock lending on security prices: An experiment. *The Journal of Finance*, *68*(5), 1891-1936.

Karmaziene, E., & Sokolovski, V. (2022). Short-selling equity exchange traded funds and its effect on stock market liquidity. *Journal of Financial and Quantitative Analysis*, *57*(3), 923-956.

Leippold, M., Su, L., & Ziegler, A. (2016). How index futures and ETFs affect stock return correlations. Working paper. Available at *https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2620955*.
Li, F. W., & Zhu, Q. (2022). Short selling ETFs. *Review of Asset Pricing Studies*, *12*(4), 960-998.
Markit (2017). Why it pays to lend ETFs. Available at https://cdn.ihs.com/www/pdf/Why-it-pays-to-lend-ETFs-brochure.pdf.
Palia, D., & Sokolinski, S. (2024). Strategic borrowing from passive investors. *Review of Finance*, Forthcoming.
Prado, P. M., Saffi, P. A., & Sturgess, J. (2016). Ownership structure, limits to arbitrage, and stock returns: Evidence from equity lending markets. *The Review of Financial Studies*, *29*(12), 3211-3244.
Ramachandran, L. S., & Tayal, J. (2021). Mispricing, short-sale constraints, and the cross-section of option returns. *Journal of Financial Economics*, *141*(1), 297-321.
Reed, A. V. (2013). Short selling. *Annual Review of Financial Economics*, *5*(1), 245-258.
Reed, A. V. (2015). Connecting supply, short-sellers and stock returns: Research challenges. *Journal of Accounting and Economics*, *60*(2-3), 97-103.
Wigglesworth, R (2017, January 24). ETFs are eating the US stock market. *Financial Times*. https://www.ft.com/content/6dabad28-e19c-11e6-9645-c9357a75844a.
Zhu, Q. (2020). The missing new funds. *Management Science*, *66*(3), 1193-1204.

Appendix: Variable definitions

Variables with "*DR_*" as a prefix are defined as the monthly decile rank of the underlying variable. Variables with "*Chg_*" as a prefix are defined as the month-over-month change of the underlying variable.

Variables	Definitions
Active AP #	The number of APs that has non-zero redemption and/or purchase on that stock in a year.
Active AP Volume	Total redemption and purchase dollar value of the stock as a percentage of its market capitalization in a year.
Alpha	The Fama-French three factor alpha
BidAskSpread	The monthly average of the daily bid-ask spread, which is calculated as the difference between bid and ask in CRSP daily database.
BorrowSize	The size of borrowing, defined as the shares on loan divided by the number of transactions on that day recorded by Markit.
CompBorrowFee	The composite borrowing fee for an ETF, calculated as portfolio-weighted monthly-average lending fee for an ETF's all constituents based on the weights in the prior month-end. It can be calculated based on either indicative fee or SAF.
CompLendFee	*CompBorrowFee* plus the *ExpenseRatio.*
CompRatio1	The ratio of *CompBorrowFee* to *LendFee.*
CompRatio2	The ratio of *CompLendFee* to *LendFee.*
CreateFee	The creation fee of each ETF obtained from the N-CEN file.
CreateFeeRatio	The creation fee scaled by the AUM size of each creation basket (i.e., creation units * price at the monthly end).
ExpenseRatio	The expense ratio of the ETFs, extracted in the CRSP fund summary dataset. If a certain year's number is missing, we use the average expense ratio of that fund in the whole available time period as a replacement.
ETF-based SIR	The ETF-based short interest ratio for a stock is calculated as the aggregate dollar value of short interest across ETFs that hold this stock divided by that stock's market capitalization.
ΔSIR	Month-over-month change in exchange-based short interest ratio
IO	Total percentage of institutional ownership, measured by the last available reported number at or prior to the month-end in the Thomson Reuters 13F database. We set missing values as zero, and values larger than one as one.
Lendable	The monthly average of the ratio of daily shares available for lending from Markit scaled by total shares outstanding. We set missing values as zero, and values larger than one as one. The daily version of this variable is only used in Table 2 and Figure 3.
IndicativeFee	The monthly average of the indicative fee variable provided by the Markit measured as percentage points.
SAF	The monthly average of the simple average fee (SAF) provided by the Markit as percentage points.
LendFeeSpread	*LendFee* minus *CompLendFee.*
Ln(MCap)	The log of market cap for stocks or asset under management for ETFs in billion dollars.
Lendmiss #	Number of constituents with missing lending data, defined as the number of an ETF's constituents with any days missing lendable shares in a month.

Lendmiss_Vol	Volatility weighted by missing lending data, calculated as the *Volatility* of an ETF's all constituents weighted by the proportion of days missing lendable shares in that months. The portfolio weights of those underlying stocks are not considered.
MktCap_$Bil	Market cap for stocks or assets under management for ETFs in billion dollars.
Momentum	Return momentum, measured by the accumulative returns of a 12-month period ending in the prior month.
Turnover	The monthly average of the ratio of trading volume scaled by total shares outstanding.
Utilization	The monthly average of the ratio of daily shares on the loan scaled by total shares available for lending, both from Markit. The daily version of this variable is only used in Table 2 and Figure 3.
Volatility	The monthly standard deviation of daily stock returns.

Table 1: Lending market and security characteristics for ETFs and stocks

This table shows the summary statistics of several lending market metrics and security characteristics for ETFs (Panel A) and stocks (Panel B) at the daily level. All variables are defined in the Appendix.

Panel A: Summary statistics for ETFs

	N	mean	sd	p1	p5	p10	p50	p90	p95	p99
Lending Market Characteristics:										
IndicativeFee	60221	4.71	4.92	0.32	0.51	0.78	3.50	9.13	11.55	22.94
SAF	26121	4.25	5.32	0.23	0.32	0.47	2.80	9.00	11.96	27.14
Lendable	54232	2.18	6.53	0.01	0.01	0.01	0.18	5.18	9.25	41.59
Utilization	54232	35.35	34.74	0.00	0.00	0.00	24.13	99.45	99.45	99.45
Security Characteristics:										
Short interest	56544	4.01	8.50	0.00	0.03	0.06	0.63	12.69	29.63	35.57
IO	60221	47.16	23.95	1.36	10.78	18.35	44.48	82.60	96.58	100.00
Momentum	56403	12.98	22.43	-45.57	-23.90	-10.93	13.08	36.99	47.88	78.68
Mcap (in $B)	60191	3.05	9.80	0.01	0.01	0.02	0.34	6.78	14.28	50.60
Ivol	57282	2.26	1.53	0.80	0.80	0.80	1.90	3.99	5.20	8.35
Alpha	51066	-0.12	0.60	-2.39	-1.08	-0.76	-0.05	0.48	0.69	1.19
Turnover	60221	33.30	47.25	1.73	4.07	5.45	15.19	85.86	179.33	199.86

Panel B: Summary statistics for stocks

	N	mean	sd	p1	p5	p10	p50	p90	p95	p99
Lending Market Characteristics:										
IndicativeFee	703134	2.81	8.33	0.26	0.28	0.29	0.39	6.26	12.86	59.77
SAF	463499	2.05	6.68	0.11	0.20	0.22	0.30	3.41	9.58	49.17
Lendable	699800	19.97	13.68	0.06	0.76	2.11	19.93	38.00	43.16	56.48
Utilization	700132	17.97	22.13	0.00	0.24	0.56	8.59	52.23	69.88	91.70
Security Characteristics:										
Short interest	693929	4.50	6.04	0.00	0.01	0.05	2.35	11.70	16.68	31.80
IO	699834	58.38	32.08	0.09	2.99	8.52	65.67	96.99	100.00	100.00
Momentum	661741	10.57	55.69	-85.33	-65.63	-50.09	4.58	69.49	109.00	255.50
Mcap (in $B)	702615	4.41	13.22	0.01	0.02	0.04	0.52	9.10	21.25	96.85
Ivol	670832	12.11	7.67	3.02	4.10	4.85	10.04	22.04	27.31	43.32
Alpha	625769	-0.03	2.25	-7.06	-4.02	-2.71	0.07	2.46	3.59	6.42
Turnover	702770	19.50	25.98	0.32	1.12	2.10	12.38Di	40.69	59.83	156.60

Table 2: Does CTL alleviate the supply constraint given the increase in shorting demand?

This table reports how the ETF and stock lending fees respond to the increase in shorting demand. All variables are defined in the Appendix. *t*-statistics in parentheses are based on standard errors clustered by firm and year-month. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ (two-sided tests)

	(1)	(2)
Dep Var = Chg_IndicativeFee		
Sample	ETF	Stocks
ΔSIRi,t	0.002*	0.009***
	(1.780)	(2.623)
Chg_Momentum	-0.002	0.001**
	(-1.091)	(2.073)
Chg_Mcap	0.006***	0.002***
	(6.260)	(2.890)
Chg_BidAskSpread	0.001	0.000*
	(1.585)	(1.868)
Chg_Lendable	-0.008	-0.009
	(-1.493)	(-1.413)
Chg_Ivol	0.059	0.134***
	(0.801)	(7.153)
Chg_Alpha	-0.059	-0.011
	(-0.786)	(-0.729)
Chg_Turnover	0.001***	0.004***
	(2.648)	(4.334)
Constant	0.000***	0.000**
	(4.668)	(2.440)
Observations	41,103	600,213
Adjusted R-squared	0.014	0.008
Sample	ETF	Stocks
Month FE	Yes	Yes

Table 3: The summary statistics on the costs and frictions of the CTL mechanism

This table presents the summary statistics of the components of lending fees and CTL friction proxies. All variables are defined in the Appendix.

Variables (in %)	Mean	sd	p1	p5	p10	p50	p90	p95	p99
Fee components:									
Expense Ratio	0.38	0.22	0.04	0.07	0.10	0.35	0.65	0.75	0.95
Based on IndicativeFee									
Lending Fee	4.71	4.92	0.32	0.51	0.78	3.50	9.13	11.55	22.94
CompBorrowFee	0.44	0.25	0.25	0.27	0.28	0.38	0.67	0.90	1.88
CompLendFee	0.82	0.36	0.33	0.40	0.45	0.76	1.22	1.46	2.48
Compratio	36.35	36.04	2.67	5.27	7.20	23.22	86.35	117.00	181.60
LendFeeSpread	3.75	3.90	-0.45	-0.09	0.11	2.67	8.35	10.73	21.85
Based on SAF									
Lending Fee	4.25	5.32	0.23	0.32	0.47	2.80	9.00	11.96	27.14
CompBorrowFee	0.35	0.20	0.11	0.21	0.23	0.28	0.52	0.71	1.50
CompLendingFee	0.73	0.38	0.29	0.34	0.38	0.68	1.09	1.29	2.13
Compratio	41.61	43.78	2.08	4.60	6.48	24.70	101.40	137.00	222.20
LendFeeSpread	3.43	4.35	-0.41	-0.13	-0.01	2.07	8.29	11.19	26.06
CTL Frictions:									
Active AP #	9.0	5.6	0	2	3	8	19	20	22
Active AP Trade Vol.	0.15	0.20	0.01	0.02	0.03	0.08	0.32	0.53	1.21
Borrowsize	9600.6	23854.8	100.3	107.1	172.8	1410.5	23332.3	54873.3	150655.3
CreateFee	724.7	670.9	150	250	250	500	1500	2500	3000
Lendmiss #	1.71	5.95	0.00	0.00	0.00	0.00	3.00	7.00	49.00
Lendmiss Volatility	0.91	1.53	0.00	0.00	0.00	0.00	2.81	3.84	7.90

Table 4: AP Market activities and the ETF lending fee spread

This table reports the relation between activities in the AP market and the ETF lending fee spread. We measure ETF lending fee spread based on indicative fees in Columns 1-2, and based on SAF in Columns 3-4. All variables are defined the Appendix. *t*-statistics in parentheses are based on standard errors clustered by firm and year-month. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ (two-sided tests)

DV = *LendFeeSpread*	Based on *IndicativeFee*		Based on *SAF*	
	(1)	(2)	(3)	(4)
DR_ Active AP #	-0.087***		-0.096**	
	(-2.7)		(-2.1)	
DR_Active AP Volume		-0.170***		-0.156***
		(-5.8)		(-4.6)
Momentum	2.358***	2.302***	2.194***	2.110***
	(4.9)	(4.8)	(3.8)	(3.6)
Ln(Mcap)	-0.536***	-0.672***	-0.679***	-0.839***
	(-8.9)	(-13.3)	(-8.6)	(-13.4)
Lendable	-3.450**	-3.855***	-3.853**	-3.963**
	(-2.5)	(-2.8)	(-2.5)	(-2.4)
Utilization	1.425***	1.498***	1.283***	1.344***
	(7.7)	(8.2)	(5.5)	(5.8)
Ivol	-19.616***	-11.204*	-27.414***	-23.455***
	(-2.9)	(-1.7)	(-3.1)	(-2.7)
Alpha	24.316*	28.221**	20.917	22.620
	(1.9)	(2.3)	(1.2)	(1.3)
Turnover	-0.156***	-0.046	-0.067	0.035
	(-2.8)	(-0.8)	(-1.1)	(0.5)
Observations	43,503	43,050	21,631	21,354
Adjusted R-squared	0.290	0.305	0.291	0.303
Time FE	Yes	Yes	Yes	Yes
Style FE	Yes	Yes	Yes	YEs

Table 5: Hedging frictions in CTL and ETF lending fee spread

This table reports the relation between hedging frictions in the CTL process and the ETF lending fee spread. We measure ETF lending fee spread based on indicative fees in Columns 1-2, and based on SAF in Columns 3-4. All variables are defined the Appendix. *t*-statistics in parentheses are based on standard errors clustered by firm and year-month. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ (two-sided tests)

DV = *LendFeeSpread*	Based on *IndicativeFee*		Based on *SAF*	
	(1)	(2)	(3)	(4)
DR_Lendmiss #	0.069***		0.083***	
	(3.2)		(3.4)	
DR_Lendmiss Volatility		0.063***		0.078***
		(3.6)		(3.9)
Momentum	2.213***	2.218***	2.033***	2.037***
	(5.0)	(5.0)	(4.0)	(4.0)
Ln(Mcap)	-0.624***	-0.620***	-0.803***	-0.799***
	(-12.9)	(-12.8)	(-13.8)	(-13.8)
Lendable	-4.010***	-3.997***	-4.452***	-4.481***
	(-3.0)	(-3.0)	(-2.8)	(-2.8)
Utilization	1.380***	1.378***	1.219***	1.215***
	(7.8)	(7.8)	(5.0)	(5.0)
Ivol	-17.283***	-18.044***	-27.389***	-27.961***
	(-2.8)	(-2.9)	(-3.2)	(-3.3)
Alpha	37.609***	37.191***	34.702**	34.364**
	(3.3)	(3.2)	(2.1)	(2.1)
Turnover	-0.200***	-0.202***	-0.105*	-0.107*
	(-3.6)	(-3.6)	(-1.7)	(-1.7)
Observations	47,499	47,499	23,064	23,064
Adjusted R-squared	0.279	0.278	0.282	0.282
Time Fe	Yes	Yes	Yes	Yes
Style Fe	Yes	Yes	Yes	Yes

Table 6: Creation fees, Borrowing Size, and the ETF lending fee spread

This table reports the relation between two features of CTL process (i.e., creation fee and borrowing size) and the ETF lending fee spread. We measure ETF lending fee spread based on indicative fees in Columns 1-2, and based on SAF in Columns 3-4. All variables are defined the Appendix. *t*-statistics in parentheses are based on standard errors clustered by firm and year-month. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ (two-sided tests)

DV = *LendFeeSpread*	Based on *IndicativeFee*		Based on *SAF*	
	(1)	(2)	(3)	(4)
DR_CreateFee	0.084**		0.106***	
	(2.4)		(2.7)	
DR_BorrowSize		-0.136***		-0.193***
		(-5.1)		(-4.8)
Momentum	2.320***	2.340***	2.068***	2.207***
	(5.3)	(5.2)	(4.0)	(4.2)
Ln(Mcap)	-0.652***	-0.456***	-0.802***	-0.585***
	(-13.1)	(-8.6)	(-13.6)	(-9.1)
Lendable	-4.060***	-3.078**	-4.351***	-3.308**
	(-3.0)	(-2.4)	(-2.9)	(-2.2)
Utilization	1.370***	1.452***	1.168***	1.339***
	(7.4)	(8.2)	(4.5)	(5.7)
Ivol	-17.126***	-16.659***	-23.802***	-25.134***
	(-2.7)	(-2.6)	(-2.8)	(-2.9)
Alpha	34.529***	28.919**	32.457*	22.278
	(2.9)	(2.5)	(1.9)	(1.4)
Turnover	-0.194***	-0.139**	-0.103*	-0.048
	(-3.5)	(-2.6)	(-1.7)	(-0.8)
Observations	45,374	47,499	22,424	23,064
Adjusted R-squared	0.286	0.280	0.287	0.285
Time FE	Yes	Yes	Yes	Yes
Style FE	Yes	Yes	Yes	Yes

Table 7: Outside ETF Lending and the Competition Effect on Stock Lending Fees

This table reports the how outside ETF lending affects the lending fee of their constituents stocks. In Panel A, we focus on ETF-based short interest ratio for each stock (calculated as the aggregate dollar value of short interest across ETFs that hold this stock divided by that stock's market capitalization). In Panel B, we disaggregate this ETF-based short interest ratio based on whether the ETFs are in the most and least expensive 20%. In both panels, we measure stock lending fee based on indicative fees in Columns 1-2, and based on SAF in Columns 3-4. All variables are defined the Appendix. *t*-statistics in parentheses are based on standard errors clustered by firm and year-month. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ (two-sided tests)

Panel A: ETF-based short interest ratio and future stock lending fees

DV = $StockFee_{t+1}$	Based on *IndicativeFee*		Based on *SAF*	
	(1)	(2)	(3)	(4)
ETF-based SIR	-0.744***	-0.490***	-1.405***	-1.159***
	(-8.8)	(-5.8)	(-6.8)	(-6.1)
IndicativeFee	0.943***	0.904***		
	(354.0)	(228.7)		
SAF			0.929***	0.875***
			(261.2)	(140.8)
Momentum	-0.085***	-0.017	-0.078***	-0.014
	(-6.1)	(-1.2)	(-5.6)	(-1.0)
Ln(Mcap)	-0.057***	-0.238***	-0.052***	-0.238***
	(-12.8)	(-13.3)	(-8.7)	(-10.9)
Utilization	-0.520***	-0.045	-0.574***	-0.151
	(-7.6)	(-0.4)	(-7.7)	(-1.2)
Lendable	0.911***	1.408***	0.860***	1.365***
	(13.7)	(16.5)	(13.6)	(16.7)
Ivol	-0.504***	-0.835***	-0.610***	-1.048***
	(-4.3)	(-3.7)	(-4.1)	(-3.8)
Alpha	-1.737***	0.313	-1.668***	0.585
	(-5.9)	(0.8)	(-5.0)	(1.2)
Numest	-0.014***	-0.002	-0.008***	0.000
	(-4.9)	(-0.7)	(-2.8)	(0.1)
Turnover	0.819***	1.071***	0.588***	0.752***
	(10.1)	(10.7)	(7.2)	(7.5)
Observations	572,999	578,464	388,640	391,507
Adjusted R-squared	0.933	0.935	0.911	0.914
Time FE	Yes	Yes	Yes	Yes
Industry	Yes	No	Yes	No
Firm FE	No	Yes	No	Yes

Panel B: Cheap versus Expensive ETF-based short interest ratio and stock lending fees

DV = $StockFee_{t+1}$	Based on *IndicativeFee*		Based on *SAF*	
	(1)	(2)	(3)	(4)
ETF-based SIR (Bottom 20%)	-0.668***	-0.574***	-0.627***	-0.543***
	(-6.4)	(-5.8)	(-4.7)	(-4.8)
ETF-based SIR (Top 20%)	-0.097	-0.089	-0.096	-0.115*
	(-1.4)	(-1.5)	(-1.6)	(-1.8)
IndicativeFee	0.943***	0.905***		
	(210.3)	(167.4)		
SAF			0.928***	0.881***
			(173.4)	(138.4)
Momentum	-0.054***	-0.011	-0.047***	-0.002
	(-4.8)	(-0.9)	(-4.4)	(-0.2)
Ln(Mcap)	-0.025***	-0.150***	-0.022***	-0.155***
	(-7.9)	(-10.6)	(-5.6)	(-9.2)
Utilization	-0.265***	-0.036	-0.297***	-0.054
	(-5.5)	(-0.4)	(-6.0)	(-0.5)
Lendable	0.717***	1.068***	0.764***	1.120***
	(12.6)	(14.5)	(13.4)	(15.8)
Ivol	-0.231**	-0.438**	-0.205*	-0.610***
	(-2.5)	(-2.5)	(-1.9)	(-3.1)
Alpha	-1.637***	-0.047	-1.697***	0.208
	(-5.9)	(-0.1)	(-5.8)	(0.6)
Numest	-0.005***	0.000	-0.003*	0.001
	(-2.6)	(0.1)	(-1.7)	(0.4)
Turnover	0.352***	0.520***	0.254***	0.399***
	(6.4)	(7.5)	(4.8)	(6.0)
Observations	454,121	457,562	349,465	351,718
Adjusted R-squared	0.914	0.917	0.886	0.889
Month FE	Yes	Yes	Yes	Yes
Industry FE	Yes	No	Yes	No
Firm FE	No	Yes	No	Yes

Table 8: Supplemental Analyses on the Competition Effect

This table reports two sets of additional analyses. In Panel A, we focus on the role of ETF lending fee in affect the competition effect of outside ETF lending on stock lending. In Panel B, we use the ETF lending fee spread to define cheap versus expensive ETFs. In both panels, we measure stock lending fee based on indicative fees in Columns 1-2, and based on SAF in Columns 3-4. All variables are defined the Appendix. *t*-statistics in parentheses are based on standard errors clustered by firm and year-month. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ (two-sided tests)

Panel A: The cross-sectional analyses based on the lending fee of stocks

DV = $StockFee_{t+1}$	Based on *IndicativeFee*		Based on *SAF*	
	(1)	(2)	(1)	(2)
ETF-based SIR	-0.565***	-0.406***	-0.872***	-0.824***
	(-7.0)	(-5.0)	(-6.1)	(-5.3)
Top Fee * ETF-based SIR	-0.610***	-0.339	-1.246**	-1.236***
	(-2.7)	(-1.6)	(-2.5)	(-2.7)
Top Fee	0.077*	-0.075*	0.485***	0.372***
	(1.9)	(-1.9)	(7.6)	(6.1)
Observations	572,999	578,464	388,640	391,507
Adjusted R-squared	0.933	0.935	0.911	0.914
Month FE	Yes	Yes	Yes	Yes
Industry FE	Yes	No	Yes	No
Firm FE	No	Yes	No	Yes

Panel B: Using ETF lending fee spread to define cheap versus expensive-to-lend ETFs

DV = $StockFee_{t+1}$	Based on *IndicativeFee*		Based on *SAF*	
ETF-based SIR (Bottom 20%)	-0.607***	-0.543***	-0.603***	-0.577***
	(-6.2)	(-6.1)	(-5.0)	(-5.3)
ETF-based SIR (Top 20%)	-0.075	-0.081	-0.071	-0.109
	(-0.9)	(-1.1)	(-1.1)	(-1.6)
Observations	437,046	440,222	344,283	346,480
Adjusted R-squared	0.906	0.909	0.884	0.888
Time FE	Yes	Yes	Yes	Yes
Industry	Yes	No	Yes	No
Firm FE	No	Yes	No	Yes

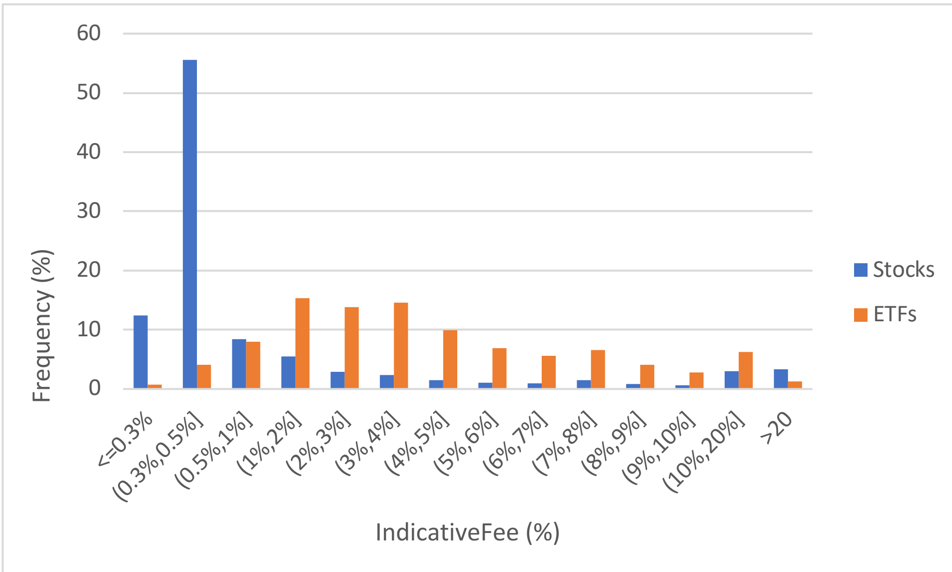
Figure 1: The size and growth of the ETF and Stock market over time

The figure shows the growth of ETFs (Panel A) and common stocks (Panel B) in the US market based on the number of securities (the bars) and the year-end market capitalization (the solid line) in 2006 $B

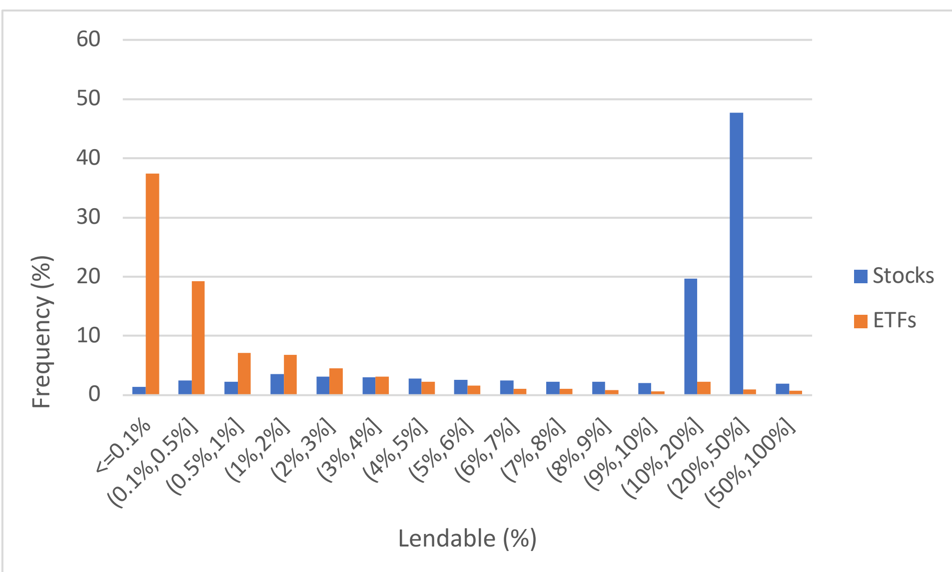
Figure 2: Distribution of ETFs and stocks' lending fees and supply

In this figure, we show the distributions of several metrics of ETFs (blue dark bars) and stocks (orange light bars) in the lending markets, including lending fees (Panel A), lendable shares (Panel B), utilization ratio (Panel C), and short interest ratio (Panel D). All variables are defined in the Appendix.

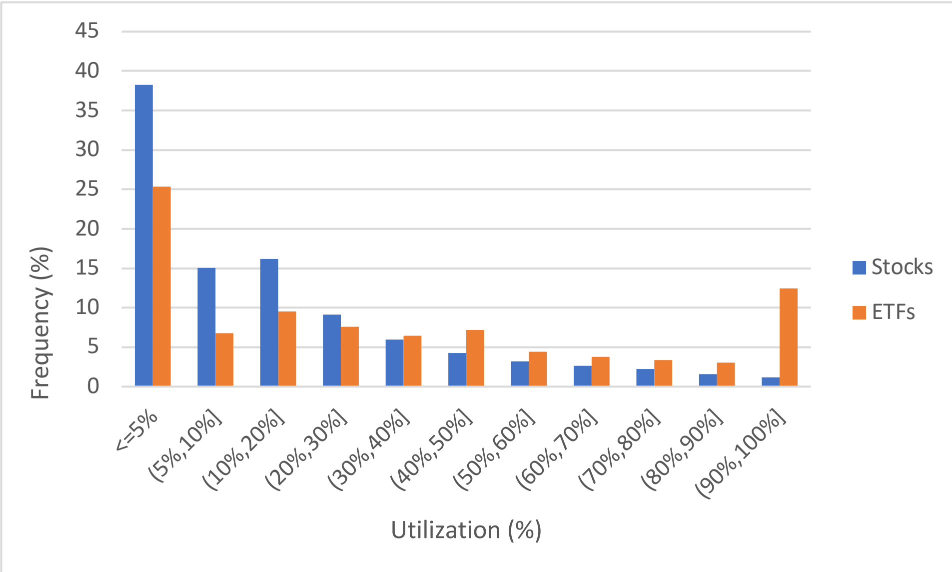
Panel A: Lending fee distributions of ETFs and stocks



Panel B: Lendable shares distribution of ETFs and stocks



Panel C: Utilization ratio distribution of ETFs and stocks



Panel D: Short interest distributions of ETFs and stocks

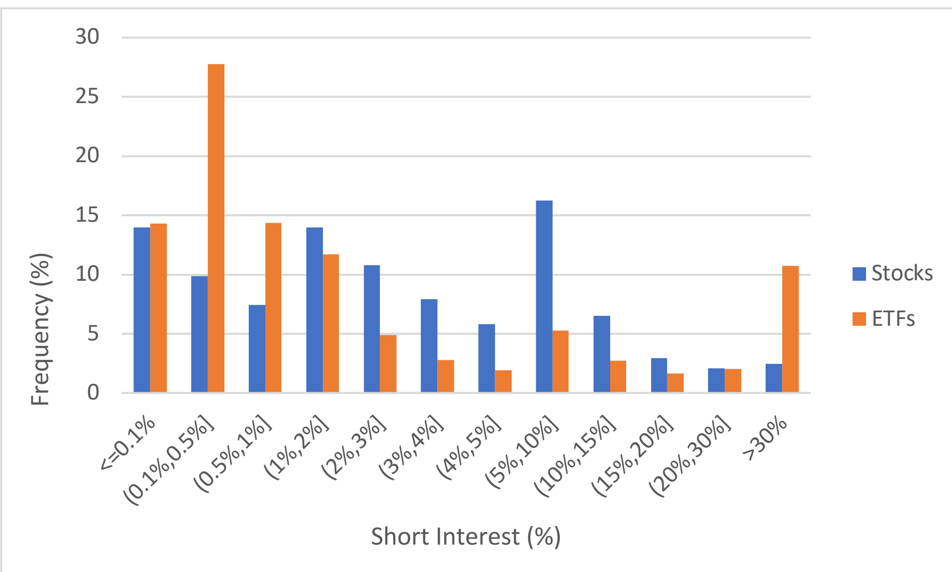


Figure 3. ETF Fee Spreads Across Investment Categories and Styles.

This figure presents whisker plots of ETF fee spreads, defined as the ETF's lending fee minus the value-weighted average lending fee of its underlying constituent securities. Fee spreads are shown for the full ETF sample, across broad ETF classifications based on investment function (four-tier categorization following Ben-David et al.), and across Morningstar style categories. Each whisker plot reports the 1st and 99th percentiles, the interquartile range, and the median fee spread