Passive Investing:
The Role of Securities Lending

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ABSTRACT

Financial economists have long touted the benefits of passive versus active investing. Transaction cost savings, the avoidance of management fees, and tax efficiency are among the claimed virtues. This study examines another important advantage—securities lending. We show that exchange traded funds (ETFs) can earn significant revenue from securities lending, on order of the size of the ETF's expense ratio. Findings for passive index mutual funds (IMFs) are similar, albeit slightly less. We also show that ETF managers respond to the securities lending incentives by slanting their holdings toward stocks with higher lending fees.

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Passive Investing: The Role of Securities Lending

In the last two decades, passive investment in equities has quadrupled while active equity investment through mutual funds has only doubled. And, the growth of passive investing continues. It is now projected to double its market share from 11% to 22% by 2020.[1] Passive investing has two basic forms: exchange traded funds (ETFs) and index mutual funds (IMFs), with the total net asset (TNA) value of each category being approximately the same. While the TNA value is only a small percentage of actively managed mutual funds, passively invested assets exceed those invested in hedge funds[2]— $2.6 vs $2.1 trillion. With more and more financial advisors recommending passive instead of active investing,[3] it is critical that we develop a more thorough understanding of this important investment strategy.

The origin of passive investing rests in the Sharpe (1964)/Lintner (1965) capital asset pricing model (CAPM). The CAPM says that investors should hold portfolios that consist of all risky securities in the marketplace, with the proportion of wealth invested in each security equal to its market value relative to the market value of all securities. The basic principle is lower risk through broad diversification. Investors simply buy and hold. Hence, the term, "passive investing."

About a decade later, John C. Bogle recognized that the advantages of passive investing extend well beyond diversification.[4] At the time, mutual funds were actively managed. This means that fund holders face significant expenses including transaction costs and management fees.

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[1] "Will invest for food," *The Economist*, May 3, 2014 citing a report by PriceWaterhouseCoopers.

[2] Mutual fund and exchange traded fund data from the Investment Company Institute Factbook (2013), hedge fund data from BarclayHedge, accessed March 2014.

[3] "US Advisers Increase Allocations to ETFs," *Financial Times*, July 28, 2013, http://www.ft.com/intl/cms/s/0/45f7ec82-f489-11e2-a62e-00144feabdc0.html. "UK Advisers Flocking to ETFs," *Financial Times*, Sept 9, 2013, http://www.ft.com/intl/cms/s/0/ecc4d976-194b-11e3-83b9-00144feab7de.html, and "Investors Pour into Vanguard, Eschewing Stock Pickers," *Wall Street Journal*, August 20, 2014, http://online.wsj.com/news/article_email/investors-pour-into-vanguard-eschewing-stock-pickers-1408579101-lMyQjAxMTA0MDIwMTEyNDEyWj.

[4] Bogle (1999) describes in greater detail the logic underlying his strong advocacy for passive investing.

Transaction costs arise from the fund manager buying underpriced or selling overpriced securities (i.e., "stock picking") or entering or exiting the market depending on directional view (i.e., "market timing"). The fees result from the fact that the manager wanting to be paid for the expectation of generating positive alpha. For actively managed funds, expense ratios (i.e., total expenses and fees dividend by TNA) can be as high as 150 or more basis points annually. Bogle recognized that expense ratios can be significantly reduced by implementing a passive investment strategy in the manner prescribed by Sharpe and Linter. In addition, he noted that passive investing provides greater tax efficiency than active investing since it generates less taxable income. Indeed, in August 1976, he formed the first IMF, the Vanguard Index Trust-500 Portfolio, benchmarked to the S&P 500 Index. At the end of 1976, its value was $14 million. At the end of 2013, Vanguard 500 Index Investor Fund Shares (VFINX), Vanguard 500 Index Fund Admiral Shares (VFIAX), and Vanguard 500 Index Fund Signal Shares (VIFSX) had a combined value of $145 billion.[5]

In the history of passive investing, the next milestone came in January 1993 when State Street Global Advisors launched the first exchange traded index fund, the SPDR S&P 500 Trust (SPY). It, too, is benchmarked to the S&P 500, so there is no difference in the degree of diversification between SPY and the two Vanguard products. In addition, their expense ratios are about the same. The main difference is that SPY trades throughout the day at market prices while VFINX, VFIAX, and VIFSX trade only at the end-of-day values. Like the Vanguard products, SPY has been a phenomenal success. When launched in January 1993, its market value was $7 million. At the end of 2013, its value was nearly $175 billion.

In this study, we argue theoretically and document empirically that passive funds have another advantage over active funds. The stocks of a passive fund are being held in the proportions dictated by the underlying benchmark index. Since there is no intention of selling the stocks in the portfolio, they are all available to lend. To lend a stock, the fund enters into a repurchase (or "repo") agreement. In a typical lending agreement, the borrower (e.g., a short seller) posts 102% of the

[5] In November 2000, remarketed the Vanguard 500 Index Trust as two separate funds. The assets reamin pooled and benchmarked to the S&P 500 index portfolio. The only distinction is that the VFINX is aimed at smaller investors (minimum investment of $3,000) and has an expense ratio of 0.17% while the VFIAX is aimed at larger customers (minimum investment of $10,000) and has an expense ratio of 0.05%.

notional value of the stocks in cash with the lender (e.g., the ETF) as collateral. The lender invests the cash collateral in money market securities, say, U.S. Treasury bills, thereby earning a market-determined risk-free rate of return. Since the interest income properly belongs to the borrower (i.e., the owner of the cash), the lender passes the interest income to the borrower, but only after extracting a lending fee. For most stocks, the lender's fee is relatively small, on order of 20 basis points annually. The risk-free rate of interest less the lending fee is called the "rebate rate." This generic rebate rate is called the general collateral (GC) rate. From time to time, however, a stock may be in short supply and hard to borrow (HTB). In such cases, the lending fee can be very high, causing the rebate rate to become negative (i.e., the borrower pays the lender interest). Most importantly, from the fund's perspective, is that it has the right to recall the stock at any time. This means that the fund's rate of return on the stock equals the realized rate of return on the stock plus the amount of the lending fee. While, in principle, nothing prevents an active fund from also engaging in securities lending, the concept of them doing so seems counterintuitive. Presumably the active fund manager is long a particular stock because he has the directional view that its price will rise. By lending the stock, he is enabling short sellers to take the opposite directional view. In addition, should the active fund manager change his directional view on the stock, he must recall the stock in order to close his position, and delivery is not instantaneous. Indeed, the risk of recall with active funds is a key factor in the borrower's decision to have passive funds as preferred counterparties.

The purpose of this study is to estimate how much revenue is or, at least, can be earned by passive investors through securities lending. Our sample spans the period January 2009 through December 2013. We focus primarily on ETFs because we have daily data on the composition of the ETF portfolios. In contrast, the holdings of IMFs are observed only quarterly. We find the results striking. While the value -weighted annual expense ratio of passive investment funds in our sample is 26 basis points, ETFs make 23-28 bps per year from securities lending. Under more conservative assumptions, ETFs make at least 9 bps per year. On the upside, if firms are aggressively optimizing their portfolio to lend and focusing on the most profitable-to-lend securities, a reasonable high-end estimate is 55-114 bps per year. Not surprisingly, securities lending revenue by ETFs has not gone unnoticed by the financial press. The *Financial Times*, for example, reported on how ETFs are more generating profit margins that are four times higher than traditional mutual funds, even though they are marketed as having lower expense ratios.[6] Another *Financial Times* article quotes a Vanguard official as saying that, due to securities lending income, the management fees for ETFs may go to zero or even become negative.[7] The estimates for IMFs are less refined due to the use of quarterly data. Using a matched sample at the lower frequency, we find that, while IMFs earn significant securities lending revenue, ETFs seem to do much better at maximizing it. One possible explanation for this is that ETF managers are mostly new entrants focused on new revenue strategies. In contrast, traditional IMF managers more likely focus on tracking error, not securities lending.[8]

We also document that ETF managers respond to opportunities to earn securities lending revenues. In the first demonstration, we show that less transparent ETFs make more securities lending revenue. While most ETFs are very transparent, many retain significant flexibility by using custom or in-house indexes. On average, the difference in revenue between transparent and non-transparent ETFs is 5-7 bps, but it can be as much as 13-18 bps per year. In the second, we focus ETFs that use an undisclosed sampling and optimization algorithms to minimize tracking error to third party indexes such as those of S&P and Russell. Modifying these algorithms to incorporate potential securities lending revenue is a small matter. Among the funds that hold only a subset of the index securities, we find that the ETF portfolio weights diverge from the underlying index weights in a manner that over-weights stocks that are profitable to lend.

Finally, certain ETFs claim that they use securities lending revenue to minimize the deviation of the fund from the underlying index. We find little support for this conjecture. Our

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[6] "Low-cost ETFs reap fat profits," *Financial Times*, July 10, 2011. http://www.ft.com/intl/cms/s/0/77f60b16-a8a9-11e0-8a97-00144feabdc0.html.

[7] "Vanguard raises the possibility of free ETFs," *Financial Times*, April 2, 2013. http://www.ft.com/intl/cms/s/0/90cea80e-9b8d-11e2-a820-00144feabdc0.html This is notable because Vanguard is one of the top 3 ETF firms (With Blackrock and State Street) who comprise 80% of the US ETF market ("Big three hog US ETF market," *Financial Times*, August 25, 2013).

[8] Evans, Ferreira, and Prado (2014) report evidence to suggest this fact may be changing, however.

assessment is based on the tracking error (i.e., the standard deviation of the difference between the ETF return and underlying index return, which measures divergence of the ETF from its benchmark) and the tracking difference (i.e., the ETF return less index return), which can be loosely interpreted as the ETF's alpha. The former is primarily of interest to those using ETFs for hedging or arbitrage strategies, while the latter matters more for ETF investors. We find that tracking error is negatively correlated with securities lending income, and tracking difference is positively correlated, indicating that ETF investors also benefit from securities lending behavior. The absolute benefit to investors is small compared to the total possible revenues, however, and is weakened or even disappears in a multivariate analysis.

There is an important caveat to this analysis. Our estimate does not account for the lending agent portion of securities lending fees – we investigate only gross revenues from securities lending.[9] This is less important because (a) both Blackrock and State Street, two of the three biggest ETF providers, are their own agent lender and thus keep the agent lending fees anyway and (b) the agent lending fee is typically about 10-20% of the revenue and so represents a relatively small slice profit. [10] The basic conclusion remains.

The outline of the paper is as follows. The first section contains a brief review of the relevant background literature. The second contains descriptions of (a) the data sources, (b) the lending revenue estimation methodology, and (c) a summary of the attributes of our sample. In section three, we focus on the estimates of securities lending revenue, and, in section four, we summarize the conclusions of the study.

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[9] The securities lending market uses an agent lender model, similar to the housing market, who takes a fee as a percent of gross profit of the transaction. We are estimating gross profit, not net of fees. Agent fees are not standard so accounting for them would require yet another estimate.

[10] "Securities lending not just for income anymore," *Financial Times*, August 20, 2013. http://www.ft.com/intl/cms/s/0/5b9c61ae-098c-11e3-ad07-00144feabdc0.html

I. Background literature

The academic literature has little stand-alone research on passive investing, although several unpublished papers on exchange traded funds have appeared recently. The closest in spirit to our work is probably Cheng, Massa, and Zhang (2013). They find that ETFs engage in cross-subsidization and cross-trading within fund families increase fund revenues. Their sample and purpose are distinctly different from ours, however. First, they use non-U.S. stocks. Our focus is exclusively on U.S. stocks. Second, they focus on synthetic ETFs. Synthetic ETFs use swaps to replicate index returns. Hence, their paper focuses primarily on the management of collateral. We investigate traditional ETFs that hold portfolios of stocks and the revenues the stocks provide from securities lending. Most of the remaining ETF literature focuses on the effect that ETFs have on the underlying stocks. Ben-David, Franzoni, and Moussawi (2011), for example, show that ETFs increase the return volatility of the underlying index. Da and Shive (2013) show that ETFs increase the pairwise correlations among the returns of the stocks held in the ETF portfolio.

The literature on securities lending is more developed. D'Avolio (2002) and Geczy, Musto, and Reed (2002) introduce the equity lending market and provide the first empirical look at how it functions, pricing, supply, and demand. Duffie, Garleanu, and Pedersen (2002) model the market theoretically to incorporate search costs and show how the stock price can exceed fundamental value since the stock price incorporates the expected revenue from lending. From there, the research moved to investigating supply and demand shifts, first with data from a single lender (Cohen, Diether, and Malloy (2007)), and more recently a broader study using data from multiple lenders (Kolasinski, Reed, and Ringgenberg (2013)). Blocher, Reed, and Van Wesep (2013) synthesize this literature in a simple supply and demand framework, linking the stock market and lending market in joint equilibrium where prices are set simultaneously in both markets. All of these studies either look at the market as a whole or from the demand side (i.e., primarily short sellers). Our study, on the other hand, focuses on the supply side of the equity lending market.

To date, only two studies have focused on the supply side. Kaplan, Moskowitz, and Sensoy (2013) engineer ‘shocks’ to the securities lending supply by convincing a mutual fund provider to make available some very valuable stocks to lend and find little evidence of a stock price effect. It is interesting to note, however, that the mutual fund manager had to be convinced to lend his shares. This is consistent with the notion that mutual fund managers, particularly actively managed mutual funds, do not like to lend their shares for fear of enabling short sellers to take the opposite directional view of the stock price. Evans, Ferreira, and Prado (2014) look at trends among mutual funds and lending behavior, and its relation to the fund's overall performance. In the end, neither of these studies addresses the issue of the profitability of securities lending behavior.

II. Data, lending revenue rate estimation, and sample description

The sample period of this study is January 2009 through December 2013. The data come from a variety of sources. The first primary source of data is ETF holdings data from Morningstar. These data include detailed holdings all U.S.-based ETFs and are free of survivorship bias.[11] The sample period begins in 2009 because most ETFs began reporting daily holdings around that time. From the universe of ETFs, we focus only on those that are replicated using U.S. stocks. Funds that are replicated synthetically are not included. Also excluded from the sample are inverse, leveraged, and preferred stock ETFs. Since the Morningstar does not include fields identifying these types of funds, they were identified by hand using fund names. We also remove Unit Investment Trusts (UITs) because UITs are not allowed by charter to lend securities. UITs include four well-known ETFs (SPY, QQQ, MDY, and DIA) as well as Merrill Lynch's now defunct HOLDRS line of ETFs.[12] Finally, we remove some obvious data errors (e.g., funds that report holdings after their closing date or that report no asset value). Aside from identifying fund holdings, the Morningstar data are also used to identify sectors, styles, and equity-based strategies using the fund's *Category* field.[13]

[11] Most physically replicated ETFs (~99%) are governed by the Investment Company Act of 1940 and so have semi-annual reporting requirements like mutual funds. Because of the nature of ETFs creation/redemption mechanism, ETFs have a market-based incentive to publicly disclose highly accurate, detailed portfolios daily. These data are not typically archived by the ETFs. Morningstar, however, collects and stores the information and sells it.

[12] Van Eck converted 6 of the HOLDRS funds into 1940 Act ETFs. These are included in our sample. (http://www.etf.com/sections/features/10553-all-the-holdrs-are-now-history-nyse-says.html)

[13] Sectors: Communications, Consumer Cyclical, Consumer Defensive, Equity Energy, Equity Precious Metals, Financial, Health, Industrials, Natural Resources, Real Estate, Technology, Utilities, and Miscellaneous. Styles: Small, Mid, Large intersected with Growth, Blend and Value (9 total).

A second source of data is ETF.com's ETF Classification System (ECS) data. The ECS data were obtained from ETF.com on April 18, 2013 and contain most of the data from each ETF's Prospectus and Statement of Additional Information (SAI). This data set parses those regulatory documents into 64 fields, including information about the index each ETF tracks, how the index is computed (if known), and whether the fund is active (as defined by filings with the Securities and Exchange Commission). This dataset also contains a *Region* field, with which we apply a geographic filter. We keep funds whose region is North America, Global, Developed World, or blank, all of which hold U.S. stocks. We exclude funds that are identified as active. Other fields that we use from the ETF.com dataset include a flag for *Proprietary Index* (i.e., an indicator that the ETF uses its own proprietary index methodology) and the expense ratio as calculated in the annual report. The ETF holdings data from Morningstar are matched with the ECS data using ticker symbols. Note that the ETF.com dataset is a point-in-time snapshot, not a time series of observations. For persistent variables like *Region* or *Proprietary Index*, the issue is of small concern. But, since expense ratios have been trending downward, the use of data from the fund's latest reporting before or on April 13, 2013, may tend to understate expense ratios in the earlier part of sample period. Spot checking annual reports from early in the sample period and comparing them to the ETF.com levels suggests that the degree of bias is small.

Our final sample includes 541 unique ETFs. For each ETF, we have total net assets, number of holdings, and several asset allocation fields (% equities, sector allocations, etc.). For each security held by an ETF, we have number of shares held, market value of those shares, portfolio weight, currency, and type code (a detailed classification of security types). The securities held are uniquely identified by CUSIP. Summary statistics for our sample of ETFs are contained in Table I. Note that we have only 22,382 ETF-month observations, significantly fewer than 32,460 total possible observations (541 ETFs times 60 months). This is because our sample includes many new ETF launches as well as closures. While the mode of monthly observations per fund is 60, the mean is 41 and the median is 51. Total Net Asset (TNA) values are highly skewed. The mean is \$866M, and the median is \$107M. The minimum TNA of \$0.6M arises for funds just starting or about to close. The mean expense ratio is 47 bps, with a minimum of 7 bps and maximum of 87 bps, all of which are as expected for physically replicated, passive ETFs. The value-weighted expense ratio (not tabulated) is 26 bps, which indicates that larger funds generally have lower expense ratios. The number of holdings range from 13 securities (typical of a small sector fund) up to well over 3,500 securities, typical of a broad-based, 'total-market' index ETF.[14]

Our holdings data on passive index mutual funds (IMFs) come from the Thomson Reuters Mutual Fund Ownership files (formerly s12 data). These data are merged with the CRSP daily stock data using MFLINKS. We use the CRSP index flag to identify index funds, remove ETFs based on the ETF flag, and choose only equity mutual funds based on the CRSP objective code (the first two digits of the code must be "ED"). Unfortunately, the MFLINKS data are only updated through March 2012 so our sample of mutual funds ends there. It includes 173 mutual funds, quarterly. The summary statistics are consistent with the stylized facts we know about mutual funds versus ETFs. There are fewer IMFs, but with more assets, typically because of their association with retirement plans. The mean TNA is $4.1B, median is $475M, both significantly higher than the corresponding ETF measures. The expense ratios show more spread, ranging from 2 bps to 245 bps and a standard deviation of 57 bps (versus 19 bps for ETFs).

Our securities lending data are from Markit (formerly Data Explorers). Markit collects data from securities lending agents each day. The data coverage is quite large, accounting for about 80% of U.S. equities. The file contains a number of fields for each "stock-day" (i.e., each stock each day). One of the fields that we use in our analysis is the utilization ratio. The utilization ratio equals the number of shares demanded divided by the number of shares supplied, and measures how constrained the lending market is at any point in time. A utilization ratio of one, for example, means that all available shares are lent out.

The Markit dataset also contains two important borrowing cost variables. The first is indicative lending fees. Our analysis requires that we have a lending fee for each stock each day. Unfortunately, these indicative fees will not serve the purpose since the data histories are incomplete. The second borrowing cost variable is the Daily Cost to Borrow Score (DCBS). The DCBS is a 1-10 integer categorization that describes how expensive a stock is to borrow, with 1

[14] Note that TNA for ETFs has been adjusted for all Vanguard funds. See Appendix A for more information.

being the cheapest and 10 being the most expensive. The scores are computed by Markit for each stock-day and are based on actual lending fees that they receive from securities dealers but are not allowed to re-distribute.

To estimate lending fees for each stock-day, we devise a compromise methodology. First, we gather all DCBS stock-day observations from the Markit data base. Occasionally, there are multiple observations because the same stock can be reported on the same day. In these instances, we round the average DCBS across duplicates to assign the nearest integer value. Next, we take observations with lending fees and DCBS scores and assemble a distribution of lending fees for the stocks in each DCBS category each month. Across all days in the sample period, the mean (median) of the ratio of the number of lending fees to number of DCB Scores was 53.8% (57.4%), ranging from a minimum of 24.3% to a maximum of 71.6%. From the lending fee distribution each month, we compute (a) the mean, (b) the median, (c) the 5th percentile (the "Low"), and (d) 95th percentile (the "High") lending fees. The mean and the median rates reflect the "typical" lending fee for stocks in each DCBS category each month. The Low and the High reflect low-end and high-end estimates, while simultaneously mitigating the effect of outliers. The four lending fee parameters are recorded for all stocks in each DCBS category in each day during the month. Note that this is not to say that there is no variation in a stock's lending rate during the days of the month. There are many instances in which a stock's DCBS changes from day to day depending on the supply and demand to borrow. In our sample, 18.8% stocks changed DCBS categories between one and five times during a month, and 4.8% of stocks changed categories six or more times.

Our lending fee estimation methodology also circumvents another problem associated with the reported fees appearing in the Markit file, that is, noise. Since there is no standard procedure in recording the fees each day, they can vary from day to day as a result of receiving quotes from different dealers with different inventories. This noise makes reliable inferences about the character of the market more challenging. Table II compares the raw lending fees with the mean and median estimates from our methodology when both are available. The total number of observations is 2,753,489. The mean reported lending fee is 113.36 bps. The estimated mean and median fees are 120.96 bps and 103.31 bps, respectively. While the differences are significant in a statistical sense, they are not economically meaningful at –7.60 bps and 10.05 bps, respectively.

The standard deviation and range of the reported fees is the case in point, however. For the reported fees, the standard deviation is 486.52 bps, with a range of –50.00 to 72,183.39 bps. The standard deviations of the mean and median fees, on the other hand, are much smaller. Indeed, tests of the equivalence of the variances reject the hypotheses that the variances of the estimated fees and the variance of the reported fees are the same. In other words, our estimation methodology serves to reduce the variability in the lending fees by almost 10% for the mean estimate and 20% for the median estimate.

Our primary source of stock market data is the daily CRSP file. From this file, we extract closing share price, share return, shares outstanding, trading volume, and closing bid/ask price quotes for each stock-day. These attributes allow us to develop an intuition for the association between lending fees and the properties of the stocks within each DCBS category. In all, we have lending fee and stock information for 5,066,530 unique stock-days from 6,329 different stocks and 1,258 trading days in the sample period January 2009 through December 2013. Table III summarizes selected attributes of the stocks in the sample including the average market capitalization (in millions of dollars), the average dollar trading volume (in millions of dollars), the average relative trading volume (i.e., shares traded divided by shares outstanding), the average annualized return volatility, the average relative bid/ask spread (i.e., the difference between the ask price and the bid price divided by the bid/ask midpoint), as well as the mean and median lending fees.

The results reported in Table III are interesting and intuitive in a number of respects. First, Category 1 stocks have incredibly high market capitalization—$4,852 million on average. This stands to reason. Stocks with such a large presence in the marketplace have generous supply, are unlikely to be difficult to borrow, and will have the lowest lending fees. At the other extreme are Category 10 stocks with an average market capitalization of only $284 million—a meager 6% of the size of the Category 1 stocks. With small supply, lending fees are naturally greater. The dollar trading volumes in the different categories mimic the market cap results. Category 1 stocks have an average daily trading volume of $42.13 million, compared to $5.39 million for Category 10 stocks.

The third column shows that relative trading volume increases as stocks become more costly to borrow. This is not surprising in the sense that this variable measures trading activity relative to the supply of shares. The higher is the trading activity relative to available supply, the more costly the stock is to borrow. Return volatility has a similar association. Category 1 stocks are much less risky, on average, than any of the other categories. Conversely, Category 10 stocks are the most risky at nearly twice the level of the Category 1 stocks. Given the trading volume and return volatility results, the fact that relative bid/ask spreads increase with the DCBS categorizations should not be surprising. The spread must reflect the market maker's inventory holding premium. As shown in Bollen, Smith, and Whaley (2004), inventory holding premium is a function of turnover and return volatility. As we move from Category 1 to Category 10, the relative bid/ask spread rises. The relative spread of Category 1 stocks, for example, is only 50 bps. In contrast, Category 10 stocks have a relative spread of 126 bps.

The final two columns in Table III contain the estimated mean and median lending fees measured in basis points (bps). Not surprisingly, they rise monotonically from Category 1 to Category 10. This should be true by Markit's construction of the DCBS categories. Note that Category 1, the least costly to borrow category, has 4,052,753 stock-days (about 80% of the full sample) contained within it. This stands to reason. On any given day, the lion's share of stocks trading are not costly to borrow. These stocks are referred to as "general collateral" because they are used primarily as repo collateral and are viewed as interchangeable. Note that the median lending fee for these stocks is 27 basis points. This is in line with past estimates. D'Avolio (2002), for example, reports a value-weighted cost to borrow of 25 bps per annum. Stocks in Category 10 are the most costly to borrow. While only about 1% of the stock-days fall into this category, the median cost of borrowing is 44.51%. At such levels, rebate rates are negative (i.e., the borrower must pay rather than receive interest from the lender). Finally, note that the median lending fee is less than the mean in each of the ten categories. This simply reflects the fact that the lending fee distribution is highly skewed to the right.

Finally, we use index weight data from S&P Dow Jones (S&P) and Russell to construct daily observations of index constituent weights. S&P provided daily observations of index constituents including index weights and divisors. Russell provided monthly data including index constituents and weights. We interpolate this data to a daily frequency by backing out the shares held each month and re-weighting daily using daily prices, while adjusting for intra-month corporate events affecting shares outstanding such as stock buybacks, issuance, and stock dividends. This daily index weight series allows us to test the drivers of ETFs' deviations from their underlying indices. [15]

III. Estimates of securities lending revenue

In this section, we turn to the primary focus of our study, securities lending revenue from passive investing. The section is divided into five parts. In the first, we show that, under realistic assumptions, ETFs earn as much revenue from securities lending as they do from expense ratios. In the second, we show that, although the securities lending revenue in passive investing can be high, it may not be passed along to shareholders. In the third, we examine passive IMFs and show that they, too, generate significant securities lending revenue, but not to the same degree as ETFs. In the fourth part, we discuss the incentives for ETFs to slant their portfolio decisions toward stocks that are more profitable to lend and find evidence that they do so. Finally, we examine the proposition that ETFs use securities lending to reduce tracking error and tracking difference to benefit investors.

A. Estimating lending revenue of ETFs

The methodology for estimating the lending fee for each stock each day was described in Section II. We estimated Low (5th percentile), Mean, Median and High (95th percentile) values for each DCBS category each month. These lending fee estimates are converted into aggregate dollar revenue. To illustrate, a stock loan of 100,000 shares at $10 a share implies a total loan value of $1M. With a 2% margin requirement, the required collateral paid to the lender by the borrower is $1.02M. If the lending fee is 50 bps, the income from a single day loan is 0.0050 x $1,020,000/360 = $14.17.

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[15] We obtain daily weights for the S&P 500, 400, and 600 (main, value, and growth), the 10 sector indexes for the S&P 500 and 600, the S&P 100, the S&P 1500, the Russell 200, 1000, 2000, 3000, MidCap (main, value, and growth), Russell MicroCap index and the Russell 50 MegaCap index.

To estimate actual dollar revenue each stock-day, we need to estimate of how many shares are lent by each investment fund each day. Since there is no means for determining the degree to which the stocks within each ETF are being lent, we experiment using three different assumptions. First, we assume that shares are lent in proportion to the stock's utilization ratio. We call this the *Util* assumption. Recall that the utilization ratio is the total shares demanded in the equity lending market divided by total shares supplied. This assumption is likely conservative in the sense that it assumes a lender is "average," that is, the lending agents evenly distribute loans among their clients. Second, we assume that passive funds optimize by lending all shares of only their most profitable holdings up to 33% of the market value of their portfolio. We call this the *Opt* assumption. Third, we assume that funds maximize their lending revenue by lending up to 50% of the market value of their portfolio. We call this the *Max* assumption. These final two thresholds arise from limits set by the SEC and are discussed in Appendix B.

Table IV summarizes estimates of lending revenue per ETF, per stock, per day. As the table shows, the sample size is large. It includes dollar lending revenue estimates for more than 99 million ETF-stock-days in Panel A and over 81 million IMF-stock-days in Panel B. Note that the number of stock-days is different from the 5,066,530 reported in Table III because multiple passive funds carry the same stock. The first column shows daily estimates with the *Util* assumption to corroborate the intuition from the example above. For ETFs, the mean revenue per day is $14.17, matching the example, but ranges from a low of $4.29 to a high of $29.61 with a median value of $11.97. The next column annualizes those numbers by multiplying by 360. These estimates range from $1,543 up to $10,660 per year, per stock, per ETF. The final two columns compute the same values but assume that all shares are lent, rather than multiplying by the utilization ratio. This corresponds to the *Opt* and *Max* strategies above which are based on lending all shares of costly-to-borrow stocks.[16] There is a significant increase in potential lending revenue to a mean value of $71.71 per day (up from $14.17) and a median of $54.75 (up from $11.97). The lowest value of

[16] Clearly, every passive fund cannot lend all shares held profitably. These estimates should be interpreted on a stock by stock basis, not in aggregate. The *Opt* and *Max* assumptions are reasonable, however, because they focus on lending all shares of costly-to-borrow stocks that are very likely supply-constrained. Thus, extra supply at the margin will be profitable to lend, not excess supply.

$28.68 per day is almost as large as the highest value ($29.61) under the *Util* assumption. The highest estimate per day is $147.65. These translate to revenues of $10,326 up to $53,155 per year with a mean of $25,814 and median of $19.711.

Panel B shows the same statistics for IMFs. Starting with the first two columns, we see that IMFs slightly lag ETFs in securities lending revenue, with daily revenues of $2.62 up to $19.08, which are about 30-40% lower than their corresponding ETF revenues. The same is true of annualized estimates in the second column. When we consider revenues from lending all shares in the third and fourth columns, however, IMFs start to track ETFs more closely. The per day revenue estimates range from $24.89 up to $129.98, which is approximately 10% less than the ETF estimates. Again, annual estimates yield a similar pattern with a mean value of $18,148 (vs $19,711 for ETFs) and a median value of $22,290 (vs $25,815 for ETFs).

To place the securities lending revenues by ETFs and IMFs in an economic perspective, we can multiply the median fees under the *Util* assumption ($11.97) by the number of unique ETFs (541) and then by the median number of holdings (94) per ETF. This yields the potential of earning $219 million per year under conservative assumptions. If, instead, we assume the mean number of holdings (248), the estimate is $578 million per year. As a comparison, from Table I, the median expense ratio across ETFs is 48 basis points and median TNA is $107 million. Multiplying these two values equals $278 million per year generated in aggregate from expense ratios. Clearly, securities lending revenue is economically significant, and on par with (or even exceeding) revenue generated by expense ratios.

We benchmark fund securities lending revenues alongside expense ratios in two ways. First, in Table V, we display estimated, annualized securities lending revenue as a percentage of total net assets, in basis points. These are directly comparable to published expense ratios. Recall from Table I that the equal-weighted expense ratio is 46 bps and the TNA-weighted expense ratio is 26 bps, and we have 22,382 ETF-month observations. To give a full view of our results, Table VI displays estimates for six combinations of assumptions. The left panel contains equal-weighted statistics, and the right column TNA-weighted statistics. For each of these, we present results for our *Util* assumption (an 'average' lender), our *Opt* assumption (lending most profitable stocks up to 33% of portfolio), and our *Max* assumption (maximizing profit up to 50% of portfolio). Thus, the upper left 'block' of results represents equal-weighted statistics under the *Util* assumption. The first two rows of each block show the mean and standard deviation for our four lending fee assumptions: *Low*, *Mean*, *Median,* and *High*. Below those, to get a better idea of the distribution of possible outcomes, we show percentile results for each of the four lending fee assumptions. The lowest results are in the upper left corner (*Low* lending fee, 5th percentile) to the highest in the lower right corner (*High* lending fee, 95th percentile). This matrix can give a quick view of the distribution of results.

First, starting with mean values, we see that our conservative *Util* assumption estimates equal-weighted securities lending revenue as 15 bps under the *Mean* lending fee assumption (13 bps for *Median*). This should be considered the lower end of the estimate. Even with our conservative *Util* assumption, the lower right corner of each matrix shows some relatively large estimates of securities lending revenue. For instance, the equal-weighted, *Util* block shows an estimate of 55 bps for the *Mean* lending fee assumption, 95th percentile and 112 bps in the lower right hand corner. The corresponding TNA-weighted statistics in the next block are 9 bps *Mean* lending fee (8 bps *Median*) with 34 bps under the *Mean* lending fee, 95th percentile and 72 bps in the lower right hand corner. These higher end estimates of our conservative assumption exceed the ETF's average expense ratios.

It is unlikely, however, that passive investment funds are also passive about securities lending if they view it as a primary source of revenue. They very likely focus on lending only the most profitable securities in their portfolio. Indeed, in describing their approach to securities lending, Vanguard (2011) says

> "Vanguard has designed its securities-lending program to capture the scarcity premium found in many hard-to-borrow securities …"

This admission turns our focus to the *Opt* assumption in the middle row. We now see mean estimates of 30 basis points under the *Mean* lending fee assumption (25 bps median). The higher end estimate (95th percentile of the *High* lending fee estimate) gives 178 bps in the lower right hand corner of the equal-weighted statistics. The corresponding value is 114 bps for the TNA-weighted statistics. The mean TNA-weighted estimate, using *Mean* lending fees is 23 basis points, approximately the same order of magnitude as the TNA-weighted expense ratio of 26 basis points. Apparently, lending revenues are at least comparable to expense ratios.

Finally, turning to our *Max* assumption in Table V, we see that most estimates are now approaching or exceeding average expense ratios. The equal-weighted mean lending revenue (*Mean* lending fee) is 35 bps, compared to 48 bps for the expense ratio. The TNA-weighted mean lending revenue (*Mean* lending fee) is 28 bps, which exceeds the TNA-weighted expense ratio of 26 bps. The 95th percentile of the equal-weighted *High* lending fee estimate (lower right corner) is now 185 basis points, almost four times the expense ratio of 48 bps.

It is important to note that, in all of these cases, the results for TNA-weighted statistics show more compelling results. This indicates that securities lending revenue is not primarily generated by low-profile, smaller ETFs. Recall that two of the largest, high profile ETFs (SPY is first in AUM and QQQ is sixth) are not included and so this result showing significant securities lending among large ETFs is relatively broad-based.[17]

Thus far, we have relied on comparisons to average expense ratios. While helpful, this may not tell the full story. So in Table VI, we preset results in the same format as Table V, but this time compute securities lending revenue as a percentage of the fund's expense ratio, and then summarize the results. Again, we have the same six blocks of results with two columns of equal-weighted and TNA-weighted and the three rows of assumptions: *Util*, *Opt*, and *Max*. Our most conservative assumption, *Util*, shows that securities lending revenue is 31% of the expense ratio computed as the mean value of *Mean* lending fee assumption. Under the *Median* lending fee, it is 27%. The corresponding values for TNA-weighted statistics are 54% and 45%. Looking at the 95th percentile row of the *Util* assumption, we already see that all values except the *Low* lending fee assumption yield securities lending revenues that exceed the expense ratio (greater than 100%). The highest value in the lower right hand corner of the TNA-weighted block, *Util* assumption is 400% – four times greater than the ETFs expense ratio.

[17] SPY, in particular, is larger than the next 3 ETFs combined.

Moving to the *Opt* assumption in the second row, the TNA-weighted mean estimate of securities lending revenue is 144% (*Mean* lending fee) and 115% (*Median* lending fee). Even the 50^{th} percentile of the *Mean* lending fee assumption (TNA-weighted) computes lending revenues to be 107% of the expense ratio. The highest value (lower right hand corner) is now 684% of the expense ratio – lending revenues almost seven times greater than expense ratios.

The *Max* assumption continues the story but with larger numbers. While it may be tempting to think of this scenario as an upper-end estimate, that would be a mistake. This scenario simply assumes that ETF providers are maximizing profit to the full extent allowed by the law. So while these results may seem very large, they should be considered realistic. The mean value, equal-weighted is 83% of the expense ratio (*Mean* lending fee) and the corresponding TNA-weighted estimate is a striking 184% of the expense ratio. Most of the values in the distribution of TNA-weighted estimates now exceed the expense ratio, up to a high-end estimate of 836%.

Overall, these results paint a clear picture that securities lending revenue is a substantial source of income for ETFs. It is often on par with the fund's expense ratio and, under realistic assumptions, can easily exceed the expense ratio, sometimes substantially.

B. Gross versus net revenue

The evidence presented thus far suggests that securities lending revenue of ETFs is a major component of the fund's income. An important, related question, however, is who earns the income. Because the ETF can and does earn securities lending revenue does not mean that it is passed along to shareholders. To gain some insight into this matter, we hand-collect information about securities lending revenue provided from ETF Annual and Semi-Annual reports of 494 ETFs during the calendar year 2012. The Statement of Operations (analogous to the income statement for a typical firm) in each report shows income to the fund from securities lending. This is a net measure. It is computed as total securities lending revenue less associated expenses. ETFs are not required to disclose total securities lending revenues or related expenses. [18]

The evidence reported in Table VII speaks for itself. Although many ETFs claim that they are returning securities lending revenue back to investors, the results indicate otherwise. The skewness in the total net asset distribution is immediately apparent. The average TNA in tercile 3 is $4.2B compared to $11.3M in tercile 1. More interestingly, perhaps, is the evidence on lending revenue. While the securities lending revenue returned to investors ranges from $4,440 in tercile 1 to $892,360 in tercile 3, we estimate revenues of $25,050 to $3.64M across the same range. Our estimates show that the upper two terciles of funds, on average, return 29-30% of estimated securities lending revenues to investors, while smaller funds return only 9.1%.

C. Index mutual funds

ETFs are the fastest growing passive investing vehicle and have, therefore, been our primary focus. But IMFs, which currently represent half the market of passively invested dollars, cannot be ignored. The analysis is necessarily less refined since IMFs disclose their holdings only quarterly, not daily as with ETFs.

To provide a frame of reference for IMFs, we build a matched sample by category. We group ETFs and IMFs into the eleven industry sectors, three market cap categories, and three style categories to control for differences in holdings. We then perform a simple *t*-test of differences using the same lending fee data. The results are reported in Table VIII. The table shows that in most cases, ETFs have greater securities lending revenue (in annualized bps) than IMFs. The difference in the means for the industry sectors ranges from –2 bps for the Real Estate Sector to about 29 bps for the Materials Sector. For eight of the eleven sectors, the difference is significantly greater than 0. Market cap and style categorizations show uniformly that ETFs outperform IMFs.

[18] One expense is securities lending agent fees. BlackRock and State Street have an exemption from the SEC that allows them to act as the agent lender for their own ETFs and, as such, collect those fees. BlackRock has started disclosing the amount they receive in agent lending fees but this does not necessarily equate to all securities lending expenses. It stands to reason that the ETFs themselves also charge (undisclosed) fees since Vanguard claims to return 100% of securities lending revenue *after fees* to investors, yet also indicates that lending income generated by the fund may push expense ratios to zero.

Consistent with earlier results, the difference is greatest for small cap and growth firms. The table also shows that the results using the median lead to the same statistical inferences as the mean.

D. Slanting/incentive behavior

Next we investigate whether ETF managers respond to the securities lending incentives. If they do, we would expect to see managers act in a manner that maximizes securities lending revenue. Managers are constrained, however. Index funds, by definition, must track their benchmark closely in order to attract and retain investors. ETFs have two basic ways in which they obtain flexibility to overweight holdings to maximize their revenue. First, they may use a proprietary, custom index, where index weights are set by the same firm that is selling the ETF that tracks the index. In this case, the manager can simply set index weights that maximize lending income. Second, ETFs that use a third party index typically employ sampling and optimization algorithms to set their ETF weights. Generally speaking, managers typically focus on liquidity, however, liquidity may not be the sole criterion. It is possible that they are optimizing jointly across liquidity and securities lending revenue.

To test the first scenario, we partition the sample between proprietary and third-party indexes and perform a simple *t*-test on the two samples mean values (adjusting for sample size and different variances). Additionally, we use a Wilcoxon non-parametric test of medians for robustness. Both results are reported in Table IX. As Panel A in Table IV shows, the difference between the mean securities lending revenue of ETFs based on proprietary indexes versus third-party indexes is significant both statistically and economically. The difference, on average, ranges from 9 to 15 bps, depending upon the lending fee assumption. Panel B shows that the difference between the medians produces a similar result. Proprietary indexes appear to earn more securities lending revenue.

To test the second scenario, we employ daily index weights of popular third party indexes. Since we know what the exact index weights should be for an index tracker, we investigate the deviation of actual ETF weights from the exact index weights. Since ETF providers claim to be optimizing based on liquidity, we compute stock-level liquidity measures such as market capitalization, average daily trading volume, relative bid/ask spread, and the Amihud (2002) measure to use as controls. For brevity, we only show results using relative bid/ask spread as a control, but the results are qualitatively similar for each measure.

The tests are conducted using first differences. The results are reported in Table X. Each variable listed is differenced daily using panel data. Thus, we investigate how a change in the lending fee affects a change in the deviation of the holdings of the ETF from the benchmark while controlling for any changes in liquidity. Presumably, changes in lending fees should have no result if they are immaterial to the portfolio choices of ETF managers. Yet we see how the coefficient on lending fee is consistently positive and statistically significant. Models 1 and 2 use the entire sample. Models 3 and 4 focus only on times when there is a change in DCBS. This eliminates noise since lending fees only come from monthly estimates with DCBS bins. The result remains the same, except that liquidity now fails to enter the specification as significant. Models 5 and 6 eliminate DCBS Category 1 since these stocks are viewed as general collateral. The focus is on the needed cash loan, not the securities. Again, there is no change in result. Economically, the result is modest, with a one standard deviation move in lending fee accounting for a 2% of standard deviation move in index weight. But, in a market where basis points matter, even that small amount of deviation on a relatively large AUM can be material.

E. Tracking error/difference

ETFs (and their advocates) claim that securities lending revenue helps them offset deviations from their underlying index to the benefit of investors.[19] If so, then we would expect to see correlation between funds with high securities lending revenue and low tracking error (or high tracking difference). Tracking error represents the absolute difference between a fund and its underlying benchmark and is usually measured as the standard deviation of the ETF return from the benchmark index return. It matters primarily to investors using ETFs for arbitrage or hedging purposes. Tracking difference, on the other hand, is the average difference between the ETF return and index return and can be viewed as the fund's alpha. Note that, given perfect index tracking,

[19] Faulty math in iShares sec-lending suit, ETF.com, February 5, 2013, http://www.etf.com/sections/blog/15919-faulty-math-in-ishares-sec-lending-suit.html

index funds have a built in negative tracking difference equal to the fund's expense ratio. If ETFs are using securities lending revenue to the benefit of investors, we should see lower tracking error and higher tracking difference among ETFs with greater securities lending revenue.

The tracking results are reported in Table XI. Panel A shows that, consistent with prediction, funds with more securities lending revenue have lower tracking error and higher tracking difference. When multivariate analysis is used, however, the results for tracking difference, reported in Panel B, are weakened and the results for tracking error disappear. Based on these results, we can conclude that the funds making the most in securities lending are doing the most to minimize deviation from their underlying index, but this behavior does not seem to be pervasive. It is possible that this result is due to very few ETFs actually engaging in securities lending. After all, we are only measuring what they could potentially be making. But, verification would require ETFs to provide more transparency on what they are lending, and how much they are making.

IV. Summary of conclusions

The virtues of passive investing have been known for many decades. Sharpe (1964) and Lintner (1965) demonstrate that investors should hold portfolios that consists of all risky assets in the marketplace, with the proportion of wealth invested in each security equal to that security's market value relative to the market value of all assets. The basic principle is lower risk through broad diversification. Investors simply buy and hold. But, the benefits from passive investing extend well beyond diversification. Buying and holding means significant transaction costs savings over active investing. It also means avoiding onerous management fees for the expectation (or, perhaps, illusion) of generating positive alpha and greater tax efficiency.

This study focuses on a relatively unexplored facet of passive investing—securities lending. With passive investing, there is no intention of selling the stocks in the portfolio. Consequently, they are all available to lend. In a typical lending agreement, the borrower (e.g., a short seller) posts 102% of the notional value of the stocks in cash with the lender (e.g., the ETF) as collateral. The lender invests the cash collateral in money market securities, thereby earning a market-determined risk-free rate of return. Since the interest income properly belongs to the borrower (i.e., the owner of the cash), the lender passes the interest income to the borrower, but only after extracting a lending fee. For most stocks, the lender's fee is relatively small, on order of 20 basis points. From time to time, however, a stock may be in short supply and hard to borrow. In such cases, the lending fee can be very high. Regardless, the fund earns an abnormal rate of return on the stock, that is, the realized rate of return on the stock plus the amount of the lending fee.

The purpose of this study is to estimate how much revenue is or, at least, can be earned by passive investors through securities lending. Our sample spans the period January 2009 through December 2013. We focus primarily on exchange traded funds (ETFs) because we have daily holdings data. In contrast, the holdings of index mutual funds (IMFs) are observed only quarterly. The results are striking. While the value-weighted annual expense ratio of passive investment funds in our sample is 26 basis points, ETFs make 23-28 bps per year from securities lending. If firms aggressively optimize their holdings to lend only the most profitable-to-lend securities, revenue can exceed 100 bps per year.

We also document that ETF managers respond to opportunities to earn securities lending revenues. We show that less transparent ETFs make more securities lending revenue. On average, the difference in revenue between transparent and non-transparent ETFs is 5-7 bps, but it can be as much as 13-18 bps per year. We also focus ETFs that use an undisclosed sampling and optimization algorithms to minimize tracking error to third party indexes such as those of S&P and Russell. We find that the ETF portfolio weights diverge from the underlying index weights in a manner that over-weights stocks that are profitable to lend.

Finally, certain ETFs claim that they use securities lending revenue to minimize the deviation of the fund from the underlying index. We find little support for this conjecture. Our assessment is based on the tracking error and the tracking difference. The former is primarily of interest to those using ETFs for hedging or arbitrage strategies, while the latter matters more for ETF investors. We find that tracking error is negatively correlated with securities lending income, and tracking difference is positively correlated, indicating that ETF investors also benefit from securities lending behavior.

There is an important caveat to this analysis. Our estimate does not account for the lending agent portion of securities lending fees – we investigate only gross revenues from securities lending.[20] This is less important because (a) both Blackrock and State Street, two of the three biggest ETF providers, are their own agent lender and thus keep the agent lending fees anyway and (b) the agent lending fee is typically about 10-20% of the revenue and so represents a relatively small slice profit. [21] The basic conclusion remains.

The results of this study should be of interest to regulators, practitioners, and investors. Blackrock and State Street have both been sued over securities lending revenue, with plaintiffs contending that the portion shared with investors is not "fair." [22] We take no position on the issue of fairness. Instead, we argue for greater transparency around which securities are lent, fees generated from this behavior, and how much is retained by the lending agent versus passed on to the fund management company, and, ultimately, the investor. Current practices are unacceptable. Investors are not allowed the opportunity to truly understand their investments and fees, thereby undermining comparisons across investments.[23] As is oft-noted in both the financial press and leading ETF industry publications, the expense ratio of ETFs is not the only "cost," and, therefore, should not be the sole differentiating factor.[24] Factors like tracking error, tracking difference, and securities lending revenue can make material differences in choosing one fund over another. Investors should be allowed to compare across ETFs in an informed manner.

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[20] The securities lending market uses an agent lender model, similar to the housing market. The agent takes a fee as a percent of gross profit from the transaction. We are estimating gross profit, not net of fees. Agent fees are not standard so accounting for them would require yet another estimate.

[21] "Securities lending not just for income anymore," *Financial Times*, August 20, 2013. http://www.ft.com/intl/cms/s/0/5b9c61ae-098c-11e3-ad07-00144feabdc0.html

[22] State Street battles two U.S. Lawsuits, FT, Feb 10, 2013, http://www.ft.com/intl/cms/s/0/04d8a890-713f-11e2-9b5c-00144feab49a.html. U.S. Pension funds sue Blackrock, FT, Feb 3, 2013, http://www.ft.com/intl/cms/s/0/4f5002de-6c5c-11e2-b774-00144feab49a.html#axzz38sI4K4zE.

[23] "iShares change good for investors," *ETF.com*, April 21, 2014, http://www.etf.com/sections/blog/21833-nadig-ishares-change-good-for-investors.html.

[24] "In ETFs, a variable worth watching," *NY Times*, April 8, 2013, http://www.nytimes.com/2013/04/07/business/mutfund/exchange-traded-funds-tracking-error-is-often-overlooked.html. "In the end, expense ratios may not matter," *ETF.com*, January 2, 2013, http://www.etf.com/sections/blog/15627-in-the-end-expense-ratios-may-not-matter.html.

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Appendix A: Vanguard Adjustment

Vanguard offers ETFs as share classes of their already very popular index mutual funds, a mechanism they have copyrighted. This setup can easily generate confusion, however, and data errors may occur when Vanguard ETF data is included with other ETFs. This is because Vanguard discloses holdings information about the entire fund combined, and separately computes the individual net asset values of each share class. Thus, Morningstar has erroneously reported fund-level total net assets, shares held, and market value of those shares, thus greatly overstating the assets held by the ETF. To obtain a more accurate measurement of ETF assets held and total net assets, we apply a NAV Adjustment Factor to the total net assets reported in Table I. This is simply the NAV of the ETF divided by the NAV of the fund, both as reported in the Annual Report for each Vanguard Fund in 2012. This approximation only affects our reporting of total net assets in Table I, not our computation of securities lending revenue. Because lending revenues are a linear function of the market value of each asset held divided by total net assets, any adjustment factor will cancel out. This is because the same adjustment would be applied to the market value of each individual asset as well as total net assets.

Appendix B: The regulation of securities lending

Any fund incorporated under the Investment Company Act of 1940 ("1940 Act")[25] is prohibited from lending more than one-third of its portfolio by market value at the time of loan initiation. Since securities lending did not start until the 1960's (Faulkner 2007), regulation of this practice relies on a sequence of SEC staff no-action letters interpreting the 1940 Act,[26] starting with a 1971-72 exchange between the SEC and State Street Bank and Trust Company, which put in place many of the guidelines used even now. The one-third of portfolio restriction first appeared

[25] All mutual funds and most exchange-traded funds are incorporated under the 1940 Act.

[26] 'no-action' letters cited in this section are available at http://www.sec.gov/divisions/investment/securities-lending-open-closed-end-investment-companies.htm

in a 1974-75 exchange with Salomon Brothers, and is based in an interpretation of Sec 18 of the 1940 Act, which regulates capital structure as having a 300% asset coverage ratio.

Due to the accounting treatment of collateral assets, however, the practical limit on securities lending is half of a fund's portfolio by market value. A November 7, 1997 letter from the SEC Chief Accountant Lawrence A. Friend clarified that cash collateral should be recorded as an asset of the fund with a corresponding liability to repay it, thus increasing the assets of the fund by the amount of collateral. A letter by The Brinson Funds date November 25, 1997 clarified that this effectively increases the market value of the fund's portfolio and thus the dollar amount of securities that can be lent. To use their example, a $100M fund could lend $50M in securities, obtain $50M in collateral, and still comply with the one-third rule since $50M is one-third of $150M, which is the total assets held by the fund including the loan collateral.

Table I
Summary Statistics of Exchange Traded Funds and Index Mutual Funds

Panel A contains summary statistics for the average monthly levels of 541 unique ETFs from January 2009 through December 2013. Many ETFs both opened and/or closed during this period and thus are not represented across the whole time period. *Total net assets* is in millions of dollars, and *Expense ratio* is as reported in the mutual fund's annual report, in basis points. *Number of holdings* is a count of the number of unique securities held. Panel B contains summary statistics for the quarterly levels of the *Total net assets* and *Expense ratios* of 173 unique passive index mutual funds (IMFs) during the period January 2009 through March 2012.

Panel A: Exchange Traded Funds (ETFs)

Variable	Number of observations	Mean	Median	Standard deviation	Minimum	Maximum
Total net assets ($M)	22,382	866	107	2,711	0.6	51,950
Expense ratio (bps)	18,526	47	48	19	7	87
Number of holdings	22,382	248	94	423	13	3,664

Panel B: Passive Index Mutual Funds (IMFs)

Variable	Number of observations	Mean	Median	Standard deviation	Minimum	Maximum
Total net assets ($M)	1,975	4,070	475	15,590	0.1	190,801
Expense ratio (bps)	1,751	59	38	57	2	245

Table II
Comparison of Reported and Estimated Lending Fees

This table compares the reported Markit lending fee, if present in the data, with the estimated lending fees using our DCBS methodology. The number of observations is 2,753,489, representing all stock-days from January 2009 to December 2013 where a reported lending fee is present in the Markit dataset. First, we compare the reported and estimated mean fee using our DCBS estimation methodology, and second we compare the reported and the estimated median fee. The equivalence of means is tested using a *t*-test on matched pairs. The equivalence of variance is tested using an *F*-test. *** represents significance at the 1% probability level.

Variable	Mean	Standard deviation	Minimum	Maximum
Reported lending fee	113.36	486.52	-50.00	72,183.39
Estimated mean fee	120.96	444.66	18.31	9,979.01
Difference from reported	-7.60***	41.86***		
Estimated median fee	103.31	389.96	7.50	6,475.00
Difference from reported	10.05***	96.56***		

Table III
Summary Statistics of Market Attributes
of Stocks in Daily Cost to Borrow Score Categories

The Daily Cost to Borrow Score (DCBS) is a 1-10 integer categorization of how expensive a stock is to borrow (1 is least expensive; 10 is most expensive). The DCBS categories are created by Markit. The sample includes all 1,258 trading days in the period January 2009 through December 2013. The total number of stocks is 6,329. The intersection of the Markit (lending rate) and CRSP (stock attribute) datasets produced 5,066,530 unique stock-days. Market capitalization and dollar trading volume are expressed in millions of dollars and represent the average across all stock days in the sample. Relative volume is the average daily volume divided by shares outstanding. Volatility is the realized return volatility over the previous 21 days and is expressed on an annualized basis. Relative spread is the difference between the end-of-day ask price and bid price divided by the bid/ask midpoint. The last two columns contain the mean and median lending fee is each DCBS category.

DCBS	No. of obs.	Market cap ($M)	Dollar trading volume ($M)	Relative volume	Annualized return volatility	Relative spread	Mean lending fee	Median lending fee
1	4,052,753	4,852	42.13	0.82%	41.47%	0.0050	36	27
2	332,665	863	9.33	0.80%	54.83%	0.0138	183	141
3	181,791	626	7.37	0.82%	54.32%	0.0131	318	289
4	151,644	435	4.30	0.75%	54.56%	0.0139	488	471
5	98,861	340	3.93	0.75%	59.51%	0.0183	741	691
6	67,591	387	5.32	1.03%	64.08%	0.0126	964	900
7	68,171	374	4.79	1.01%	65.68%	0.0150	1,367	1,279
8	33,104	419	6.30	1.13%	66.02%	0.0126	2,040	1,779
9	33,498	405	7.53	1.48%	75.92%	0.0143	2,403	2,213
10	46,452	284	5.39	1.91%	81.79%	0.0126	5,278	4,451
All	5,066,530	3,998	35.06	0.84%	44.94%	0.0068	190	165

Table IV
Lending Revenue by Individual Stock

This table shows the estimated revenue from securities lending per individual stock. Two different assumptions are made about the amount of stock lent. *Util* assumes that shares are lent in proportion to the utilization ratio in the market. If the utilization ratio is 70% and the fund owns 100 shares, only 70 are lent. *All* assumes that all 100 are lent. Estimated lending revenue is reported on a daily and an annualized basis.

Panel A: ETFs No. of obs.: 99,222,917

Variable	Per day Mean (*Util*)	Annualized Mean (*Util*)	Per day Mean (*All*)	Annualized Mean (*All*)
Low (5%)	$4.29	$1,543.12	$28.68	$10,325.90
Mean	$14.17	$5,101.82	$71.71	$25,814.89
Median	$11.97	$4,308.73	$54.75	$19,711.79
High (95%)	$29.61	$10,659.82	$147.65	$53,155.48

Panel B: IMFs No. of obs. 81,630,957

Variable	Per day Mean (*Util*)	Annualized Mean (*Util*)	Per day Mean (*All*)	Annualized Mean (*All*)
Low (5%)	$2.62	$942.18	$24.89	$8,959.52
Mean	$9.31	$3,350.77	$61.92	$22,289.87
Median	$8.05	$2,896.55	$50.41	$18,148.42
High (95%)	$19.08	$6,870.26	$129.98	$46,793.61

Table V
Benchmarking Securities Lending Revenue (% of Total Net Assets)

This table benchmarks ETFs' securities lending revenue by computing is as a percentage of total net assets, in basis points. There are six blocks of results: a left and right column, and upper, middle, and bottom row. The left panel provides equal-weighted averages across ETFs, the right panel provides TNA-weighted averages across ETFs. The upper block of results are for the *Util* assumption ("average" lender), the middle the *Opt* assumption (optimize up to 33% of portfolio), and the bottom the *Max* assumption (optimize to the 50% max allowed). Within each of the six blocks (e.g. the upper left block is the *Util* assumption, equal-weighted), we show a distribution of results for our Low, Mean, Median, and High lending fee assumptions. Standard deviations are not meaningful for weighted averages and are not reported. The total number of observations in all cases is 22,382.

			Equal-weighted				TNA-weighted			
		Lending Fee:	Low	Mean	Median	High	Low	Mean	Median	High
Util assumption		Mean	4	15	13	31	3	9	8	19
		Standard deviation	11	32	28	66				
	Percentile	5th	0	1	1	2	0	1	1	2
		25th	1	3	2	5	1	2	2	5
		50th	2	5	4	11	1	5	4	10
		75th	3	14	12	29	3	8	7	17
		95th	17	55	49	112	10	34	29	72
Opt assumption		Mean	9	30	25	61	8	23	18	47
		Standard deviation	14	43	38	89				
	Percentile	5th	1	9	7	18	2	11	8	23
		25th	4	13	10	27	5	14	11	29
		50th	6	17	14	36	7	17	13	35
		75th	8	31	24	61	8	22	17	45
		95th	26	88	76	178	16	55	46	114
Max assumption		Mean	12	35	29	72	10	28	22	59
		Standard deviation	15	43	38	89				
	Percentile	5th	2	11	8	22	3	16	12	32
		25th	6	18	14	38	8	20	15	40
		50th	10	23	18	48	10	22	18	48
		75th	11	36	28	72	11	28	21	59
		95th	29	93	79	185	20	62	50	128

Table VI
Benchmarking Securities Lending Revenue (% of Expense Ratio)

This table benchmarks ETFs' securities lending revenue by computing it as a percentage of the ETF's expense ratio. As in Table VI, There are six blocks of results: a left and right column, and upper, middle, and bottom row. The left panel contains equal-weighted averages across ETFs, the right column contains TNA-weighted averages across ETFs. The upper block of results are for the *Util* assumption ("average" lender), the middle the *Opt* assumption (optimize up to 33% of portfolio), and the bottom the *Max* assumption (optimize to the 50% max allowed). Within each of the six blocks (e.g. the upper left block is the *Util* assumption, equal-weighted), we show a distribution of results for our Low, Mean, Median, and High lending fee assumptions. Standard deviations are not meaningful for weighted averages and are not reported. The total number of observations in all cases is 18,526.

			Equal-weighted				TNA-weighted			
		Lending Fee:	Low	Mean	Median	High	Low	Mean	Median	High
Util assumption		Mean	9%	31%	27%	64%	16%	54%	45%	114%
		Standard deviation	19%	56%	49%	120%				
	Percentile	5th	1%	2%	1%	4%	2%	4%	3%	9%
		25th	2%	5%	4%	11%	4%	14%	11%	28%
		50th	3%	13%	10%	26%	9%	29%	24%	58%
		75th	8%	33%	28%	67%	21%	76%	66%	171%
		95th	35%	121%	106%	251%	54%	180%	155%	400%
Opt assumption		Mean	21%	68%	56%	141%	50%	144%	115%	300%
		Standard deviation	27%	78%	66%	165%				
	Percentile	5th	2%	14%	11%	28%	9%	28%	22%	59%
		25th	8%	25%	19%	51%	22%	66%	51%	135%
		50th	13%	45%	35%	91%	37%	107%	82%	220%
		75th	26%	81%	65%	167%	71%	225%	193%	444%
		95th	64%	205%	172%	421%	122%	318%	266%	684%
Max assumption		Mean	28%	83%	66%	170%	68%	184%	144%	382%
		Standard deviation	31%	84%	70%	176%				
	Percentile	5th	3%	16%	13%	34%	12%	39%	30%	82%
		25th	11%	34%	27%	71%	31%	91%	71%	187%
		50th	19%	56%	44%	115%	53%	141%	109%	290%
		75th	35%	102%	82%	211%	98%	283%	235%	574%
		95th	78%	235%	191%	480%	164%	388%	301%	836%

Table VII
Lending Revenue as Disclosed by Exchange Traded Funds

This table shows the estimated revenue from securities lending returned to investors in 2012. We hand collect the annual report from 494 ETFs in 2012 and document the amount of identified securities lending revenue included in the ETF's Statement of Operations (analogous to an Income Statement). Shown are summary statistics by *total net asset* terciles. Tercile is in the first column, followed by mean total net assets within that tercile. The middle column displays the average securities lending revenue returned to investors, followed by our estimate of securities lending revenue generated by the fund using the mean lending fee estimation methodology, adjusted by the utilization ratio. The last column is the mean of the ratio of reported securities lending revenue to total estimated revenue.

ETF net assets tercile	Mean total net assets (in thousands of dollars)	Securities lending revenue returned to investors (in thousands of dollars)	Estimated total securities lending revenue (in thousands of dollars)	Mean ratio of revenue returned to estimated total revenue
1	11,287.40	4.40	25.05	9.1%
2	97,412.80	33.87	158.72	29.8%
3	4,208,374.66	892.36	3,641.75	29.3%

Table VIII
Comparing ETFs to Index Mutual Funds

This table compares the lending revenue generated by ETFs with passive index mutual funds (IMFs). IMF holdings are only available quarterly, are matched with lending fee data on the reporting date, and then matched one again with corresponding ETF revenue data by category. We manually match the Morningstar Category and CRSP Objective Code to compare sector funds (the first nine rows) and fund style (the last 6 rows). All rates reported in the table are annualized and expressed in basis points. Data displayed assuming the utilization ratio (*Util*) for shares lent, but results are similar with other assumptions. The mean rates reported for ETFs and IMFs are significantly different from 0 across all categories. *** represents significance at the 1% probability level.

	ETF	IMF	ETF	IMF		ETF	IMF	
	No. of	No. of	Mean (*Util*)			Median (*Util*)		
Category	obs.	obs.	Mean	Mean	Difference	Mean	Mean	Difference
Telecom	440	39	8.1	9.1	-1.05	6.8	8.0	-1.21
Consumer Services	781	39	15.2	12.3	2.90***	13.1	10.7	2.48***
Consumer Goods	606	39	10.0	5.0	4.98***	8.5	4.5	4.06***
Materials	375	26	27.9	6.5	21.45***	24.4	5.7	18.72***
Financial	1,442	39	7.2	6.8	0.34	5.8	5.7	0.06
Health Care	1,255	39	14.8	4.4	10.40***	12.5	3.7	8.78***
Industrials	1,465	39	9.9	4.3	5.52***	8.6	3.6	4.92***
Natural Resources	1,574	52	19.8	5.4	14.46***	17.8	4.6	13.21***
Real Estate	871	45	7.3	9.2	-1.88***	5.8	7.6	-1.80***
Technology	1,653	78	16.3	3.4	12.94***	14.3	2.8	11.48***
Utilities	589	78	5.2	3.9	1.29***	4.5	3.3	1.18***
Large Cap	5,478	2,087	6.4	2.8	3.58***	5.4	2.3	3.09***
Mid Cap	2,801	868	14.5	12.0	2.53***	12.4	10.1	2.30***
Small Cap	2,179	1,051	31.6	21.3	10.36***	27.4	18.5	8.86***
Blend	4,319	273	14.0	6.2	7.78***	12.0	5.3	6.70***
Growth	2,837	1,134	17.9	6.0	11.94***	15.5	5.2	10.26***
Income	3,302	78	11.3	2.8	8.54***	9.7	2.3	7.37***

Table IX
Comparing Proprietary to Third Party ETF Indexes

Test of whether ETFs on Proprietary indexes slant their portfolios toward holdings with greater securities lending revenue. The variable under investigation is monthly securities lending revenue, in annualized basis points. In Panel A, we use a simple *t*-test of means comparing proprietary and third indexes under the *Opt* lending assumption (33% of portfolio) and the *Max* lending assumption (50% of portfolio) assumptions. In Panel B, we address the same hypotheses using a Wilcoxon test of medians since the distribution of securities lending revenue is not normal. *, **, and *** represents significance at the 10%, 5%, and 1% probability level, respectively.

	Opt assumption (33% of portfolio)			*Max* assumption (50% of portfolio)		
Panel A: Test of means						
	Proprietary	Third party	Difference	Proprietary	Third party	Difference
Low	10.76	9.27	1.49**	12.95	11.63	1.32*
Mean	40.51	30.04	10.47***	44.67	35.12	9.54***
Median	33.62	24.86	8.76***	36.74	28.59	8.15***
High	82.65	61.13	21.52***	91.12	71.61	19.51***
Number of observations	293	22,089		293	22,089	
Panel B: Test of medians						
	Proprietary	Third Party	Difference	Proprietary	Third Party	Difference
Low	7.14	6.49	0.66***	10.17	9.50	0.67***
Mean	28.58	17.26	11.32***	32.60	22.76	9.84***
Median	22.52	13.45	9.07***	25.47	17.68	7.79***
High	59.07	36.04	23.03***	69.83	48.13	21.70***
No. of obs.	293	22,089		293	22,089	

Table X
Comparing ETF Weights to Index Weights (third party indexes)

Test of whether ETFs tracking third party (fully transparent) indexes slant their portfolios toward holdings with greater securities lending revenue. Regression is of first differences (all variables), at the individual holdings level. The dependent variable is Delta = ETF weight – Index weight. Lending fee is computed from DCBS distribution, where the mean is used. Relative spread is the difference between the ask and bid prices divided by the bid/ask midpoint. Standard errors are clustered by ETF-CUSIP. Models 1 and 2 use the whole sample, Models 3 and 4 look at the subset where the DCBS bin changes (either up or down) and models 5 and 6 eliminates DCBS bin 1, which is most of the sample and where stocks are very inexpensive to borrow. Values in parentheses are *t*-ratios. *, **, and *** represent significance at the 10%, 5%, and 1% probability levels, respectively.

	Whole Sample		Change in DCBS Only		No General Collateral	
	(1)	(2)	(3)	(4)	(5)	(6)
	Delta	Delta	Delta	Delta	Delta	Delta
Lending Fee (Mean)	0.3973*	0.4034*	0.4231**	0.4269*	0.4087*	0.4030*
	(1.91)	(1.94)	(1.98)	(1.90)	(1.84)	(1.81)
Spread	0.9755***	0.9697***	2.7705	3.7637	-0.7400	-0.7460
	(2.67)	(2.66)	(1.21)	(1.49)	(-0.81)	(-0.80)
Constant	-0.0004	-0.2871	0.0027	0.2449	0.0012	1.0206***
	(-0.79)	(-0.44)	(0.40)	(0.82)	(0.72)	(3.66)
No. of observations	4,846,343	4,846,343	18,020	18,020	120,165	120,165
R-squared	0.00	0.00	0.00	0.01	0.00	0.00
Clusters	12,695	12,695	1,834	1,834	1,424	1,424
Time dummies	No	Yes	No	Yes	No	Yes

Table XI

Securities lending revenue, tracking error, and tracking difference.

Quantifying the relation between the lending revenues and two measures of ETF deviation from its underlying index. Tracking difference (ETF return less index return) is computed daily and accumulated into a monthly measure. Tracking error is the standard deviation of the ETF return less the benchmark index return and is measured across the days in a month. Lending revenue is aggregated monthly from daily observations. Low, Median, Mean, and High correspond to the lending fee distribution created from the DCBS categories. Panel A reports the Spearman rank correlations, and Panel B reports the slope coefficient from a regression with intercept. *, **, and *** represent significance at the 10%, 5%, and 1% probability levels, respectively.

	Lending revenue							
Lending revenue assumption	Tracking difference				Tracking error			
	Low (5%)	Mean	Median	High (95%)	Low (5%)	Mean	Median	High (95%)
Panel A: Spearman rank correlation								
Util lending	0.033**	0.050***	0.047***	0.044***	-0.0031	-0.0031	0.0028	0.0075
Opt lending	0.0024	0.043***	0.049***	0.033**	-0.036**	-0.0242	-0.0110	0.0138
Max lending	-0.0204	0.0160	0.029*	0.0067	-0.061***	-0.037**	-0.0169	0.0034
Panel B: Regression (with intercept) slope coefficient								
Util lending	0.2811	0.2233**	0.1994**	0.1035**	0.1658**	0.1398***	0.1147***	0.0518***
Opt lending	0.0541	0.1234	0.1153*	0.0565*	0.0300	0.0966***	0.0645***	0.0359***
Max lending	-0.0015	0.1206	0.1085	0.0489	-0.0677	0.0719***	0.0329*	0.0236**