

# **Are Investors Better Off Doing Nothing During Exchange-Traded Fund Closures?**

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# **Are Investors Better Off Doing Nothing During Exchange-Traded Fund Closures?**

## **Abstract**

We investigate a sample of several Exchange-Traded Funds (ETFs) that closed between 2012 and 2019. Our findings show that ETFs close after positive returns and flows. Moreover, both returns and flows are good predictors of the ETFs' decision to close. In general, we also find that small ETFs earn greater daily returns on average than larger ETFs with the same investment objective. We finally highlight that after the closure announcement, investors are better off keeping calm and doing nothing while waiting to receive shares' cash at the NAV from the ETF issuer.

**JEL Codes:** G11; G14.

**Keywords:** ETFs; Closure.

## 1. Introduction

*“A decade ago, not a single exchange traded product in the US was killed off, but last year the cull reached triple digits for the first time ever. The culls are likely to become more brutal in the coming years, as competition heats up further and platforms are likely to introduce fees for offering an ETF, making many smaller vehicles less viable.”*

- Financial Times, 15<sup>th</sup> December 2016

Over the last decade, investments in Exchange-Traded Funds (ETFs) have grown rapidly, accounting for nearly one-third of trading volume on U.S. exchanges. As of December 2017, the ETF market stood above \$460bn, namely, around \$1.8bn of new money every day of the year, and in January 2018, it reached \$5tn for the first time.<sup>1</sup> The rise in these investment products is due to their apparent low costs and high transparency. For instance, although the U.S. Securities and Exchange Commission (SEC) only requires actively managed ETFs to publish daily information on their holdings, many index-based ETFs also comply with this requirement. Moreover, the authorized participants (APs) creation-redemption process allows investors to trade them continuously during the day. Specifically, when the ETF price is greater than the net asset value (NAV), APs create ETF shares, and when the price is smaller than NAV, the APs redeem shares.

The high growth of the ETF market draws attention to the reasons and implications behind the closure of many ETFs that increase yearly. For instance, in 2018 and 2019, around 100 ETFs closed versus 80 ETFs in 2012. Moreover, between 2012 and 2019, around 30% of the ETFs closed down. In general, all funds follow the same four-step closure process. First, the ETF announces closing down. Second, on average, one month after the official closure announcement, trading and the creations/redemptions are halted. Third, there are few days to liquidate, and the ETF distributes the cash to investors. Several risk factors, such as the issuer’s strength, competition, low assets

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<sup>1</sup> Article entitled “ETF growth is ‘in danger of devouring capitalism’”, published in the *Financial Times* on February 5, 2018 (<https://www.ft.com/content/09cb4a5e-e4dc-11e7-a685-5634466a6915>). Article entitled “ETF market smashes through \$5tn barrier after record month”, published in the *Financial Times* on February 11, 2018 (<https://www.ft.com/content/5cf7237e-0cdc-11e8-839d-41ca06376bf2>).

under management, and liquidity, provide possible flags regarding their closures. However, none of these factors explains the occurrence of these closures and their implications for investors.

After the closure announcement, investors are facing two options. These are to either sell their shares before the final trading day or hold them until the cash distributions and receive the shares' cash equivalent at ETF's NAV. Although investors do not lose their investment in both cases, the closure could be inconvenient and costly, exposing them to, e.g., the reinvestment risk, tax burden, closing costs, and trading fees. On the one hand, many investors trying to sell the closing ETF shares may drive ETF prices to decrease below the NAV. As such, investors could close their position at a higher discount than they usually do. This is definitely, less attractive than receiving cash at NAV value.

On the other hand, investors may incur capital gains subject to tax if they are not exiting from the closing ETF before the liquidation day. The higher the number of investors exiting the closing ETF, the higher the capital gains distribution to remaining investors. Moreover, although the ETF issuer generally covers the costs associated with its closure, it might also charge investors. For instance, in March 2009, SPA MarketGrader ETFs charged their investors around 10% of the NAV. MacroMarkets LLC, in December 2009, charged its investors around 4% of the NAV, i.e., a cost of approximately \$0.85 to \$0.90 per share.

Further, the International Organization of Securities Commissions (IOSCO) raises concerns that "...large institutional investors, known as authorized participants, could manipulate the prices of ETFs to create profitable trading opportunities".<sup>2</sup> As such, the APs' engagement in the creation-redemption mechanism solely when it is to their benefit might adversely impact investors, especially if they anticipate the closure of ETFs. In particular, APs could sell ETF shares and buy the basket of securities and, thus, drive the ETF price to increase far above NAV such that, after the closure announcement, to obtain a better profit. Therefore, during the days before the closure announcement, investors might buy at a higher price (premium) and, after the announcement, sell at a lower price (discount) than the fair value of the underlying securities, NAV.

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<sup>2</sup> Article entitled "Global regulatory body to launch fresh probe into ETFs", published in the *Financial Times* on December 2, 2018 (<https://www.ft.com/content/56bc520c-d5d9-11e7-a303-9060cb1e5f44>).

This paper provides new evidence on the impact of the closure on ETFs' performance, flow, and fees. It also discusses the effects of the closure on investors. In particular, we address several questions as follows. For instance, what are the main determinants of an ETF closing down? Are investors better off selling their ETF shares immediately after the closure announcement? Do investors benefit more if waiting a few days after the closure announcement? Or does the option of doing nothing provide the best benefits for investors? To address these questions, we hand-collect unique information on the closure announcement date for a sample of 633 ETFs closed between January 2012 and December 2019.

Our paper contributes to Bris et al. (2007), showing that mutual funds close after a period of high performance and inflows and are larger than other similar funds. Authors also find that managers raise their fees to compensate for the closing costs, yet this fee increase does not compensate investors with an increase in performance. We extend this study by examining the determinants and implications of ETF closures, which differ from mutual funds. Indeed, results show that closing ETFs are significantly smaller than other active ETFs. However, their flows and performance are remarkably similar to other ETFs, especially the month before the closure announcement. We also show that these significantly matter for the ETF closure decision. Moreover, we highlight that higher flows improve the performance of large closing ETFs, i.e., with a high TNA ratio, whereas consistently affecting small closing ETFs, which earn significantly higher average daily returns than large ETFs.

We also add to Angel et al. (2016), who argue that ETF transaction costs are not as low as investors might assume and that besides the net expense ratio, "an investor's true transaction cost is the amount of the deviation from the contemporaneous NAV." In particular, it finds that when investors buy shares at a premium and sell them at a discount, transaction costs are higher than the bid-ask spread. Our study emphasizes the higher management fees and the expense ratio in the year before the closure announcement than the month following the announcement. Additionally, it points out that after the closure announcement, investors are better off keeping calm and doing nothing while waiting to receive shares' cash at the NAV from the ETF issuer rather than selling them at a significant discount. However, if the ETF issuer charges other fees, they would benefit more from selling immediately after the closure announcement.

The remainder of this paper is organized as follows. In Section 2, we describe the ETF closures data. Section 3 discusses our empirical evidence, and Section 4 concludes.

## 2. Data

To construct the sample of closing ETFs, we first obtain from Bloomberg a list with the names and trading symbols of the closing and active ETFs. As no database provides the announcement date of the ETF closures, we then rely on the Google browser to hand-collect these dates. Specifically, for each ETF, we search the closure announcement dates using variations of keywords such as “the fund announced the ETF closure” or “the ETF fund is closing.”

Our dataset consists of a sample of 633 ETFs that closed from January 2012 to December 2019.<sup>3</sup> The volume, number of shares outstanding, bid/ask quotes, ETF price, and returns are from the Center for Research in Security Prices (CRSP). The net asset value (NAV) and CRSP style codes of closing and active ETFs are from the CRSP Mutual Funds Database.

Table 1 presents the characteristics of the ETFs sample. Specifically, we report the number of closing ETFs and the other ETFs active during a specific year by their investment objectives as classified by the CRSP US Mutual Fund Database.<sup>4</sup> The last column reports the percentage of closing ETFs from those currently active. Over time, we observe an increase in closing and other ETFs, with the latter increasing faster than the former, especially during the last two years of our sample, i.e., 2018 and 2019. For instance, in recent years, the closing and other ETFs are near 100 versus around 80 and over 1650 versus 600 in 2012. We find that over 30% of ETFs have closed down during our sample period, with the highest closures occurring in 2012 and 2014, namely, approximately 13% and 11%, respectively. Examining the ETFs by their investment objectives, we observe that during our sample period, the number of ETFs with equity domestic and foreign investment objectives is larger than those with fixed income and fixed income and equity objectives. Moreover, equity domestic closing and other ETFs dominate the entire sample, being close to half of it, namely, around 43% and 46%. On the contrary, when considering the proportion of the closing ETFs in active ETFs, fixed income and equity ETFs exhibit the greatest closure rate,

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<sup>3</sup> We choose 2012 as the start of our sample due to the increase in the number of ETFs closing down and respectively, in those currently active. At the same, the ETF fees are only available from 2012.

<sup>4</sup> We also graphically report the number of closing and other active ETFs by year and investment objectives in Figure 1 from the Supplementary Appendix.

i.e., 61.9%, whereas fixed income ETFs present the lowest rate, i.e., 21.9%. Nevertheless, the closure rate of equity domestic and foreign closing ETFs is yet large, around 29% and 35%, respectively.

INSERT TABLE 1 HERE

### 3. Results

#### 3.1 Characteristics of closing ETFs

Table 2 presents mean and median comparisons of key characteristics between closing ETFs and exiting active ETFs, namely, the other ETFs, matched by the closure date. In particular, we report the lagged returns, excess returns, Jensen's  $\alpha$ , the standard deviation of returns, TNAs, flows, volume, and expenses. To determine how significantly different the mean and median of these variables are, we also report the  $t$ -test and Wilcoxon rank test, respectively.<sup>5</sup>

Following Bris et al. (2007), we define the ETF flows from period  $t-1$  to  $t$  as follows:

$$ETF\ flow = \frac{TNA_t - (1 + r_t)TNA_{t-1}}{(1 + r_t)TNA_{t-1}}$$

where  $TNA_t$  is the ETF's TNA at time  $t$ , and  $r_t$  is the ETF's return over the prior month. Given the universe of all other ETFs' alignment on the closure date, the lagged values represent the ETF characteristics just before the closure month. We estimate Jensen's  $\alpha$  using daily returns over twelve months before the closure date or, if not available, at least nine months.

Table 2 shows that the median closing ETF is over 100 times smaller than other ETFs, with the former ETFs managing \$ 6.19 million, whereas the latter active ETFs manage \$ 671.51 million. Moreover, the closing ETFs' volume is over 60 times significantly larger than the trading volume of other ETFs in the month before the closure announcement. Closing ETFs are also significantly riskier than other active ETFs, with the standard deviation of their return over the past 12 months before the closure of 1.26% versus 0.81%, respectively. In addition, they charge higher fees, with the median closing ETFs net expense ratio of 0.57% compared to 0.47% of other ETFs.

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<sup>5</sup> Table 1 from Supplementary Appendix also reports the mean and median comparisons of key characteristics between closing and other ETFs by investment objectives, matched by the closure date.

Exploring the closing ETFs' flows and returns, we note that in the six months before the closure announcement, ETFs experience positive flows and earn positive returns. Although the average and median returns and flows are not significantly different from those of other ETFs, their magnitude is near or higher than that of other ETFs. For instance, the daily average of returns and flows of closing and other ETFs over the half-year before the closure announcement is 0.017% versus 0.02% and 0.07% versus 0.02%, respectively. Towards the closure announcement date, i.e., one month before, daily average returns of closing and other ETFs drop to -0.09% and -0.12%, whereas average flows are around 0.01% for closing and other ETFs. Interestingly, comparing the six-month average returns to those in the last month before the closure announcement, the other active ETFs exhibit a more pronounced reduction in average returns than closing ETFs. These findings may imply that even though the closing ETFs are risky, investors do not necessarily benefit more from investing in them half-year before the closure announcement than in other ETFs. Consequently, they are not compensated with higher returns for the high level of risk taken.

INSERT TABLE 2 HERE

Overall, although closing ETFs are significantly smaller, riskier, and charge higher fees than other active ETFs, which in the first instance may justify the closure decision, we interestingly remark similar flows and returns in the six months before the closure announcement. Moreover, the closing ETFs present a less noticeable reduction in average returns in the last month before closure than the other ETFs.

We further estimate a cross-sectional logistic regression to determine the characteristics of closing ETFs. Specifically, the dependent variable is a dummy that takes value one if the ETF has closed down and zero otherwise (i.e., the ETF is open or active). The independent variables are those from Table 2. In line with previous findings from Table 2, large ETFs are less likely to close, e.g., the AUM coefficient in the one month prior to closure announcement remains highly significant and negative, around -0.02, throughout all models' specifications. ETFs with high net expenses are also less likely to close, e.g., the coefficient of the one-month lagged net expense ratio is significantly negative at the 1% level in each model specification.

We next note that ETFs' flows and returns are worthy positive predictors of ETFs' closure decisions. For instance, the significantly positive coefficients of flows (e.g., 0.42 and 0.41) signal



that ETFs with large positive flows one month before the closure announcement present a high likelihood of closing. The coefficients of average raw returns six months before the announcement are significantly positive, indicating that ETFs with high returns are more likely to close.

INSERT TABLE 3 HERE

### **3.2 The relationship between size, flows, and performance**

Section 3.1 shows that although, in general, the closing ETFs are riskier, smaller, and exhibit a lower trading volume than other ETFs, their flows and performance around closure announcements are higher or close to those of other ETFs. Moreover, a month before the announcement, large positive flows and returns are relevant for the ETF closure decision. Accordingly, the question is, if these funds' flows and performance are similar to those of other ETFs, why are they closing down? This section addresses this question by examining the size relationship between flows and performance. While the studies of Chen et al. (2004) and Bris et al. (2007) show that large mutual funds may underperform, which, in turn, affects their decision to close, examining the ETFs' closures, we observe opposite effects concerning the size of closing ETFs but an underperformance of other ETFs one month before closure announcement. This finding suggests that the closure announcement of ETFs impacts the existing ETFs continuing to trade on the exchange.

In line with the study of Bris et al. (2007), every day since January 2012, we sort the closing ETFs on their TNA ratios on that day and lagged six-month cumulative abnormal flows. In particular, we construct 25 independent quintile portfolios from the intersection of the lagged flow and TNA ratio quintile sorts and take their mean every day until the last portfolio formation. To account for the variation in ETFs' size across various investment objectives, we calculate the TNA ratio by dividing the TNA of the closing ETF to the median TNA of all other ETFs with the same investment objective. We obtain the daily abnormal flows by subtracting the median flow of all other ETFs with the same investment objective from the flow of a given closing ETF. These flows are then cumulated over the past six months to obtain six-month cumulative abnormal flows. Table 4 presents the average daily returns, Carhart's four-factor  $\alpha$ , and their  $t$ -statistics in Panels A and B. We estimate the  $\alpha$ s by regressing the daily portfolio returns, in excess of the risk-free rate, on the four factors.

Panel A of Table 4 shows that, in general, closing ETFs with low and medium TNA ratios earn significant positive daily average returns. In contrast, those with higher ratios, i.e., from the last two quintiles, earn negative returns. Regarding the abnormal flows, we find that these flows matter more for large than small closing ETFs. For instance, considering the first three columns capturing the quintile portfolios with small ETFs, generally, the average returns are significantly positive between 0.01% and 0.05%, disregarding whether or not the flows are low or high. Instead, examining the last two columns, we usually note significantly negative returns that decline as the flows increase from the low to the high quintile. These findings suggest that size plays an essential role in closing ETFs. Hence, these are to some extent consistent with Bris et al. (2007) in that as the closing ETFs experience high TNAs, this growth negatively impacts their performance.

Similarly, in Panel B, we find that as the TNA ratio rises, the  $\alpha$ 's are significantly smaller, suggesting that small ETFs earn greater abnormal returns than large ETFs. We again confirm the highest importance of flows for ETFs with high than low TNAs and, thus, while small ETFs do not require high flows to earn positive returns, high flows to large ETFs lead to better performance. In appendices A.2 and A.3, we show the relationship of average volatility and volume over the past six months with size and performance. Consistent with previous results, Appendix A.2 shows that small ETFs exhibit a similar performance regardless of the average volatility, whereas large ETFs earn positive returns solely when volatility is high. Likewise, Appendix A.3 highlights that the trading volume generally has the same effect on performance for small ETFs, but a small trading volume negatively influences the performance of large ETFs. Overall, the above findings point out that ETF managers may close down an ETF to reduce the adverse effects of flow, risk, and trading volume on large ETFs' performance.

INSERT TABLE 4 HERE

### **3.3 The flows, performance, and fees around the closure announcement**

In this section, using an event study and time-series framework, we explore the behavior of flows, performance, and fees around the announcement of the ETFs' closure, i.e., one year before to around two months after closing. In particular, Panel A of Table 5 reports the closing ETFs' cumulative excess and raw returns and flows in an event-study framework. Panel B of Table 5 presents the cross-sectional means of time-series daily averages of flows, returns, volume,

premium/discount, and spread from one year before to the month after closing, whereas Table 6 reports the fees. We compute the excess returns and flows with reference to a style benchmark. Specifically, we first find all other ETFs with the same investment objective for each closing ETF and then take their mean return and median flow as the style benchmark return and flow, respectively.

Panel A shows a steady decrease of the raw flows from 3.18% the 10<sup>th</sup> to 12<sup>th</sup> month before the closure announcement to -4.94% one month after the announcement. Note that these flows are positive until one month before the closure announcement. Up to the six months before the closure announcement, there are also positive excess flows over the median investment style. The excess flows significantly decrease one month before the closure announcement from -0.28% to -2.20% and -5.52% one month and two months after the announcement, respectively. In general, closing ETFs display positive raw returns until the closure announcement, when they decrease to -0.15% and then rise to 0.66% one to two months after the announcement. This significant decline and increase in excess flows and raw returns, especially during the last months after closure, might be associated with the few ETFs which notify many days in advance about their closure. Instead, we document decreasing negative excess returns over both the equal-weighted index and median investment style, e.g., excess returns drop from -3.46% to -1.14% and -1.59% to -0.37% before the closure announcement month, respectively. Our results highlight the small closing ETFs' underperformance to other ETFs with the same investment style around closure announcement.

From the time-series perspective, Panel B again emphasizes the significant difference in flows, Jensen's alpha, volume, and spread one year before to one month after the closure announcement. Closing ETFs exhibit significant positive raw flows and returns one year before the closure announcement, and after the announcement, they decrease and increase, respectively. After the closure announcement, we also note an increase in volume, spread, Jensen's  $\alpha$ , and significant negative flows. Moreover, the ETFs' shares trade at a higher significant discount than before the closure announcement suggesting that investors may sell ETFs at a discount after the closure announcement and, thus, might also bear higher losses depending on when they sell them.

INSERT TABLE 5 HERE

Figure 1 further shows the closing ETF cumulative raw and excess returns and flows and TNA ratio around the closure announcement date. Specifically, Panels A and B display the cumulative raw and excess flows and returns (i.e., style and equal-weighted index) one year before to one month after the closure announcement. Panel C displays the TNA ratio of closing ETFs estimated by dividing the TNA of closing ETFs daily by the median TNAs of all other ETFs with the same investment style as the closing ETF.

Panel A documents, in general, an increase and decrease in cumulative raw and excess returns around the closure announcement. For instance, we observe negative cumulative raw returns until around six months before the closure announcement. Afterward, they increase and became more prominent, especially two months before the closure announcement. Instead, the cumulative excess returns over the equal-weight index and median investment style are negative, displaying a constant decreasing trend. Panel B shows positive cumulative raw and excess flows with a steady rising trend as the raw returns. In Panel C, we note that the TNA ratio of the closing ETF to that of the median ETFs with the same investment objectives exhibits a declining trend over the year before the closure announcement. For instance, the TNA ratio falls from around 0.25 to 0.19 at the closure time. This finding confirms the previous results and suggests that closing ETFs are, on average, 80% smaller than the median ETFs in the same investment objective.

INSERT FIGURE 1 HERE

Finally, Table 6 presents time-series averages of the management fees, other expenses, and expense ratio one year before to one month after the announcement date. To manage an ETF's investment portfolio, the investment manager typically charges management fees as a percentage of the ETF's AUM. The other expenses are not included in the management fees, such as the custodial, legal, accounting, transfer agent, and other administrative expenses. The net expense ratio is the amount an investor pays after accounting for the impact of reimbursements and contractual waivers. Table 6 documents the significant differences between the management fees and expense ratio after and before the closure announcement. For example, on average, management fees and expense ratio significantly diminish to \$11.9 million and 0.624% after the closure announcement, respectively, from \$13.4 million and 0.634% one year before the announcement. These findings align with Warner and Wu (2005), who show that mutual fund

managers typically increase their fees following high performance and asset growth. Therefore, in our case, these might indicate that managers are aware of the good performance of closing ETFs and that these ETFs may close in the future. As such, they raise the fees before the closure announcement to compensate for the possible expenses associated with ETF closures.

INSERT TABLE 6 HERE

Our findings so far typically highlight the positive and negative raw flows and returns over the one year before the closure announcement, respectively. This underperformance of closing ETFs to the other active ETFs with the same investment style may be due to them being very small when comparing them with other active ETFs with the same investment style, e.g., approximately 80% smaller. Moreover, although closing ETTs are small, previous Section 3.2 shows that flows and performance vary for the large and small closing ETFs. Hence, excess flows and returns might also fluctuate within the closing ETFs. In other words, a relationship may exist between size and the closing ETF excess flows and excess returns over the median flows and average returns to other ETFs with the same investment objective, respectively. Accordingly, we first sort the closing ETFs into quintiles using their TNA ratio one week before the closure announcement and then present an event study's results like the one from Panel A of Table 5.

Table 7 reports the year before to two months after the closing announcement, the average cumulative excess flows, and returns of the closing ETFs to a style benchmark by TNA ratio in Panels A and B, respectively. Panel A documents positive excess flows for ETFs with medium TNA ratio, i.e., the third quintile, during the 12<sup>th</sup> to 4<sup>th</sup> month before the closure announcement and, generally, for the ETFs with a high TNA ratio, whereas small ETFs typically exhibit negative flows. After the closure announcement, ETFs with a high TNA ratio exhibit more significant cumulative excess negative flows than ETFs with a low TNA ratio. This result is consistent with Table 4, where we show that high flows to ETFs with a high TNA ratio lead to better performance. Therefore, it is not surprising that investors' inflows are higher in other ETFs with the same investment objective as the closing ETF after the closure announcement.

Exploring Panel B, we note that ETFs with both low and high TNA ratios earn negative excess cumulative returns over the one year before to after the closure announcement. However, small ETFs underperform more large ETFs. The above results suggest, to some extent, a relationship

between closing ETFs' size and both the excess flows and performance, respectively. Appendix A.4 confirms our findings when sorting closing ETFs into tercile by their TNA ratio. In addition, there is weak evidence that ETFs closing at a larger size earn positive excess returns among the closing ETFs after the closure announcement.

INSERT TABLE 7 HERE

### **3.4 Discussion on the implications of the ETFs' closures**

The previous sections have mainly explored the long-term behavior of closing ETFs' flows, returns, and fees, e.g., from one year before the announcement to two months after the closure. In this section, we further examine closing ETFs' behavior by focusing on the period surrounding the closure announcement and especially those days following the announcement, e.g., around ten days before to 20 days after the closure announcement. In doing so, we aim to understand better the impacts that closure announcements have on ETF investors who can either sell their shares after closure or wait for the official liquidation date. Nevertheless, if investors choose the first option to sell after the closure announcement, the question is, when are they benefit more or bear lower losses? By choosing to sell the ETF shares straight away or waiting a few days after the announcement?

Figure 2 displays raw returns and flows and the premium/discount of the closing ETFs around the closure announcement in an event study framework. While Panel A shows constant positive raw returns before the closure date, which appears to rise slightly following the announcement, the positive raw flows in Panel B display an opposite trend, e.g., increasing and declining after the closure announcement. However, besides the returns and flows, especially around the closure announcement, it is also essential to consider whether ETF shares are trading at a premium or discount. As such, in Panel C, we plot the one-week rolling average premium/discount computed as the average difference between the closing ETFs' price and NAV. If the ETF price is greater than the NAV, then ETF shares are trading at a premium, whereas if it is lower than NAV, then ETFs' shares are trading at a discount. In line with Table 5, we note that most times, the shares of closing ETFs are trading at a discount over the one year before and after the closure announcement.

INSERT FIGURE 2 HERE

Interestingly, however, one month before the closure announcement, closing ETFs' shares are trading at a premium. Examining the premium/discount even nearer to the closure announcement, e.g., ten days before the announcement, we also remark that ETF shares trade at a premium for several days, whereas following the announcement, closing ETF shares trade at a high discount. These results imply that APs anticipate the closure of ETFs and potentially benefit from them rather than losing as other investors. For instance, the high premium before the announcement suggests that APs sell ETF shares driving up the ETF's price so that after closure, they repurchase them and, finally, redeem with the ETF issuer at a higher NAV. Moreover, APs also anticipate investors' substantial sale of shares following the closure announcement that may be eventually due to i) the concern about being charged other fees or ii) not being aware of or understanding the closure impacts on their investment. Moreover, as it is not known whether an issuer may charge any closure fees to investors, it is plausible that most investors are not willing to take this risk and sell after the closure announcement.

On the contrary, investors buy the closing ETF shares at a premium before the closure announcement, and after the announcement, they can sell them or wait and receive the shares' cash at the NAV from the issuer. Given that, after the closure announcement, ETF shares are trading at a significantly high discount, and trading volume is significantly high, as Table 5 and Panel C of Figure 2 highlight, we can conclude that many investors are indeed selling their shares after the announcement. To better emphasize the effects of the ETF closures on investors, we look at the average returns they may earn if participating in the closing ETF market. For instance, let us first assume that investors buy the closing ETFs' shares before the closure announcement, and in particular, we consider each day over the past year. Second, after the closure announcement, we posit that they might sell them one day and a week after the closure announcement or wait for the liquidation date. Relying on these assumptions, we estimate the holding period returns and plot them in Figure 3. Regardless of the timing of buying the closing ETF shares, average daily returns are usually negative whenever investors sell them after the closure announcement, namely, either one day or a week, but as they wait for longer, the worse the performance. Interestingly, investors typically earn positive average returns while keeping calm and waiting for the liquidation date without selling their shares after the closure announcement.

INSERT FIGURE 3 HERE

Our empirical results suggest that investors might limit their losses by waiting to receive the value of the shares in cash at NAV rather than selling them as soon as they are aware of the closure. Thus, the option to “do nothing” might provide investors with better outcomes assuming that the ETF issuer is not charging any closing fees as a percentage of NAV. Instead, if the issuer charges even a tiny percentage of NAV, e.g., 1%, Figure 3 highlights that investors are better off selling as fast as possible after the closure announcement. Overall, it makes sense as the APs only engage in trading ETF shares when it benefits them, and after the closure announcement, it is in their best interest for the NAV to be as high as possible because they need to redeem the shares with the ETF issuer.

#### **4. Conclusion**

This paper investigates the determinants of the ETFs’ closure from January 2012 to December 2019. Using a unique sample of the hand-collected announcements of the ETFs closing down, we assess the reasons behind their closures and their influence on investors.

We find that returns and flows over the past six months and one month, respectively, before the closure announcement, positively predict the decision of ETF to close down. In addition, even though closing ETFs are significantly smaller than the other active ETFs, size matters within closing ETFs. For instance, while small ETFs earn greater daily returns on average than large ETFs with the same investment objective without being dependent on the flows, large ETFs’ performance improves with the flow’s growth. Around the closure announcement, we document a smaller underperformance of closing ETFs to other ETFs with the same investment objective as during the months before the announcement. Our results also show that when the ETF issuer does not charge extra closing fees, investors may be better off doing nothing after the closure announcement, namely, chilling out and waiting to receive the value of the shares in cash at NAV. Instead, if they are unwilling to assume, e.g., this or other tax risks, investors are better off selling their ETF shares immediately after the closure announcement.



## References

- Bris, A., Gulen, H., Kadiyala, P., & Rau, P. R. (2007). Good stewards, cheap talkers, or family men? The impact of mutual fund closures on fund managers, flows, fees, and performance. *The Review of Financial Studies*, 20(3), 953-982.
- Chen, J., Hong, H., Huang, M., & Kubik, J. D. (2004). Does fund size erode mutual fund performance? The role of liquidity and organization. *American Economic Review*, 94(5), 1276-1302.
- Warner, J. B., & Wu, J. S. (2005). Changes in mutual fund advisory contracts. *Working Paper*.

**Table 1: ETFs sample description**

		Closing ETFs	Other ETFs	%
2012	Equity domestic	55	415	13.3%
	Equity foreign	11	114	9.6%
	Fixed income	2	10	20.0%
	Fixed income and equity	7	15	46.7%
	Others	8	69	11.6%
	Total	83	623	13.3%
2013	Equity domestic	18	374	4.8%
	Equity foreign	10	130	7.7%
	Fixed income	2	94	2.1%
	Fixed income and equity	.	.	.
	Others	.	.	.
	Total	30	598	5.0%
2014	Equity domestic	42	319	13.2%
	Equity foreign	20	223	9.0%
	Fixed income	11	142	7.7%
	Fixed income and equity	5	17	29.4%
	Others	3	59	5.1%
	Total	81	760	10.7%
2015	Equity domestic	18	471	3.8%
	Equity foreign	22	275	8.0%
	Fixed income	12	177	6.8%
	Fixed income and equity	5	26	19.2%
	Others	1	12	8.3%
	Total	58	961	6.0%
2016	Equity domestic	36	465	7.7%
	Equity foreign	24	348	6.9%
	Fixed income	16	169	9.5%
	Fixed income and equity	4	34	11.8%
	Others	8	76	10.5%
	Total	88	1092	8.1%

Continued

**Table 1 (continued): ETFs sample description**

		Closing ETFs	Other ETFs	%
2017	Equity domestic	36	547	6.6%
	Equity foreign	40	383	10.4%
	Fixed income	16	200	8.0%
	Fixed income and equity	4	39	10.3%
	Others	11	95	11.6%
	Total	107	1264	8.5%
2018	Equity domestic	41	821	5.0%
	Equity foreign	30	432	6.9%
	Fixed income	10	276	3.6%
	Fixed income and equity	5	52	9.6%
	Others	8	99	8.1%
	Total	94	1680	5.6%
2019	Equity domestic	28	722	3.9%
	Equity foreign	32	448	7.1%
	Fixed income	11	275	4.0%
	Fixed income and equity	9	63	14.3%
	Others	12	141	8.5%
	Total	92	1649	5.6%
Full sample	Equity domestic	274	956	28.7%
	Equity foreign	189	538	35.1%
	Fixed income	80	366	21.9%
	Fixed income and equity	39	63	61.9%
	Others	51	170	30.0%
	Total	633	2093	30.2%

Note: This table presents the closing ETFs. In particular, it shows the total number of sample ETFs that closed between 2012 and 2019 by their investment objectives, as reported by the Center for Research in Security Prices (CRSP) survivorship-bias free US Mutual Fund Database.

**Table 2: Characteristics of the closing ETFs over the entire sample**

	Closing ETFs	Other ETFs			Closing ETFs	Other ETFs		
	Mean		Difference	<i>t-statistics</i>	Median		Difference	Rank test
ETF one-month-lagged TNA (\$ million)	21.63	940.52	918.89	7.51	6.19	671.51	665.33	29.93
ETF one-month-lagged raw returns (%)	-0.092	-0.123	-0.03	-0.56	-0.026	-0.049	-0.02	-1.28
ETF average raw returns months -6 to -1 (%)	0.017	0.020	0.00	0.82	0.023	0.024	0.00	0.03
Jensen's alpha (style %)	-0.007	-0.009	0.00	-0.57	-0.0003	-0.0033	-0.0030	-3.21
Std. dev. of ETF returns over past 12 months (%)	1.26	0.81	-0.44	-10.86	1.01	0.78	-0.23	-8.94
Mean one-month-lagged ETF flow (%)	0.01	0.01	0.00	0.05	0.0181	-0.04	-0.06	-4.62
Mean ETF flow months -6 to -1 (%)	0.07	0.02	-0.06	-2.22	-0.005	0.00	0.01	5.90
One-month-lagged net expense ratio (%)	0.62	0.55	-0.06	-4.64	0.57	0.47	-0.10	-2.76
One-month-lagged volume (units of one share)	5319	340562	335243	20.12	1029	242305	241276	28.89

Note: This table compares the mean and median for closing ETFs with those for the universe of all other ETFs, matched on the closure date. Given this alignment on the closure date, the lagged values represent the ETF characteristics just before the closure month. We define the ETF flow as  $[TNA_t - (1 + r_t) TNA_{t-1}] / (1 + r_t) TNA_{t-1}$ . Jensen's  $\alpha$  is computed using daily returns over 12 months before the closure date. If the ETF does not have 12 months of data, all available data are used for at least nine months. To examine how significantly different the mean and median of these variables are, we report the *t*-test and Wilcoxon rank test, respectively.

**Table 3: Determinants of ETF closures**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	3.01 *** (16.95)	3.00 *** (16.68)	2.99 *** (16.72)	2.93 *** (15.71)	3.67 *** (12.75)	3.59 *** (11.92)	3.62 *** (11.85)	3.55 *** (10.72)
ETF one-month-lagged AUM (\$ million)	- 0.02 *** (-15.47)	- 0.02 *** (-15.48)	- 0.02 *** (-15.39)	- 0.02 *** (-14.20)	- 0.02 *** (-15.34)	- 0.02 *** (-13.97)	- 0.02 *** (-14.24)	- 0.02 *** (-13.81)
ETF average raw returns months -6 to -1 (%)		1.92 *** (2.36)			1.65 ** (2.08)		1.84 * (1.85)	1.76 * (1.72)
ETF one-month-lagged raw returns (%)						0.089 (0.99)		0.09 (0.96)
Jensen's alpha (style %)				1.37 (0.72)		- 0.66 (-0.36)	- 1.71 (-0.85)	- 2.15 (-1.01)
Std. dev. of ETF returns over past 12 months (%)								0.06 (0.38)
Mean ETF flow months -6 to -1 (%)			-0.004 (-0.02)		- 0.05 (-0.21)		- 0.01 (-0.02)	-0.003 (-0.01)
Mean one-month-lagged ETF flow (%)						0.422 ** (2.07)		0.41 ** (1.99)
One-month-lagged net expense ratio (%)					- 0.98 *** (-3.33)	- 0.95 *** (-3.07)	- 1.00 *** (-3.22)	- 1.03 *** (-2.97)

Note: This table presents findings for a cross-sectional logistic regression to examine the characteristics of closing ETFs. The regression is estimated as follows. We assign the closing ETF a dummy of 1 and others 0 and regress this on control variables that proxy ETF performance and net expense ratio. Explanatory variables are as defined in Table 2. The *t*-statistics are in parentheses.

**Table 4: ETF flow/TNA ratio quintile portfolio returns for the general ETF sample**

Flow	TNA ratio						<i>t</i> -statistics					
	Low	Q2	Q3	Q4	High	Hi-Low	Low	Q2	Q3	Q4	High	Hi-Low
Panel A: Average daily returns												
Low	0.01%	0.05%	0.04%	-0.08%	-0.05%	-0.06%	0.38	1.80	2.45	-3.99	-1.90	-2.16
Q2	0.03%	0.05%	0.02%	-0.04%	-0.01%	-0.04%	1.65	2.76	1.41	-2.30	-0.52	-1.48
Q3	0.03%	0.04%	0.02%	-0.06%	-0.01%	-0.04%	1.77	1.88	0.93	-2.36	-0.45	-0.96
Q4	0.04%	0.05%	0.09%	0.01%	-0.001%	-0.04%	2.09	2.62	3.33	0.37	-0.05	-1.30
High	0.05%	0.04%	0.01%	0.01%	0.03%	-0.02%	2.46	1.67	0.60	0.41	0.83	-0.72
Hi-Low	0.041%	-0.02%	-0.02%	0.09%	0.08%	.	1.79	-0.37	-0.73	3.49	2.68	.
Panel B: Four-factor $\alpha$ s												
Low	-0.02%	0.02%	0.008%	-0.11%	-0.09%	-0.08%	-1.16	0.99	0.73	-6.72	-4.52	-3.02
Q2	0.0002%	0.02%	-0.004%	-0.06%	-0.04%	-0.04%	0.02	1.56	-0.31	-4.25	-2.19	-1.66
Q3	0.005%	0.009%	-0.01%	-0.09%	-0.03%	-0.02%	0.38	0.44	-0.72	-4.22	-1.28	-0.73
Q4	0.02%	0.02%	0.060%	-0.02%	-0.03%	-0.04%	0.91	1.41	2.03	-1.06	-1.41	-1.50
High	0.015%	-0.001%	-0.02%	-0.02%	0.005%	-0.02%	1.01	-0.10	-0.89	-0.99	0.17	-0.64
Hi-Low	0.03%	-0.02%	-0.03%	0.08%	0.10%	.	1.69	-0.88	-1.18	3.40	3.23	.

Note: This table presents average daily returns and Carhart's (1997) four-factor  $\alpha$ s for the 25-quintile portfolios during January 2012 to December 2019-sample period. Every day, starting January 2012, we sort the ETFs using their total net asset (TNA) ratios in that day and their lagged six-month cumulative abnormal flows. We compute the TNA ratio of an ETF by dividing the TNA of the ETF to the median TNA of all other ETFs with the same investment objective. We obtain the daily abnormal flows by subtracting the median flow of all other ETFs with the same investment objective from the flow of a given ETF. These flows are then cumulated over the past six months to obtain six-month cumulative abnormal flows. We then construct 25 independent quintile portfolios from the intersection of the lagged flow and TNA ratio quintile sorts and take their mean every day until the last portfolio formation. Panel A reports the average daily returns and their *t*-statistics. Panel B reports the Carhart four-factor  $\alpha$  estimates obtained by regressing daily portfolio returns, in excess of the risk-free rate, on the four factors.

**Table 5: Cumulative flows and returns earned by the ETFs around the announcement date**

Panel A: Event-study returns for closing ETFs							
	-12 to -10	-9 to -7	-6 to -4	-3 to -1	-1 to 0	0 to 1	1 to 2
ETF flow	3.18%	2.48%	0.81%	0.18%	-0.01%	-4.94%	-2.14%
	(2.03)	(0.78)	(0.50)	(0.15)	(-0.01)	(-4.76)	(-2.70)
ETF flow over median investment style	2.23%	1.56%	-0.61%	-0.22%	-0.28%	-2.20%	-5.52%
	(1.42)	(0.49)	(-0.38)	(-0.18)	(-0.40)	(-2.79)	(-5.01)
Raw Returns	-0.78%	0.29%	0.89%	0.39%	0.19%	-0.15%	0.66%
	(-1.82)	(0.74)	(2.09)	(1.31)	(0.87)	(-0.66)	(3.20)
Excess returns over EW index	-3.46%	-2.50%	-1.97%	-1.18%	-1.14%	-0.33%	-0.64%
	(-8.58)	(-6.56)	(-4.94)	(-4.54)	(-5.88)	(-1.71)	(-2.75)
Excess returns over mean investment style	-1.59%	-0.55%	-0.47%	-0.44%	-0.37%	0.08%	-0.22%
	(-4.41)	(-1.55)	(-1.22)	(-1.96)	(-2.08)	(0.43)	(-1.15)

Panel B: Time-series averages one year before to one month after the announcement date						
	Before	After	Difference	<i>t-statistics</i>		
	Before	After	Difference	Before	After	Difference
Flows	0.078	-0.328	-0.406	4.00	-2.91	-3.48
Raw Returns	0.012	0.026	0.014	3.45	1.92	0.97
Excess returns (EW index)	-0.032	-0.034	-0.002	-9.63	-2.34	-0.13
Excess returns (style)	-0.003	-0.004	-0.001	-1.01	-0.32	-0.06
Jensen's alpha	-0.007	0.040	0.047	-2.19	2.48	1.86
Volume	7368	9860	2493	6.82	8.86	2.46
Premium/Discount	-0.016	-0.031	-0.015	-1.81	-2.57	-0.70
Spread	0.012	0.013	0.001	7.33	7.06	2.17

Note: This table presents the average raw and cumulative excess returns and cumulative excess flows to the closing ETFs. We calculate the excess returns and flows concerning a style benchmark. Specifically, we find all other ETFs with the same investment objective for each closing ETF and use their mean return (median flow) as the style benchmark return (flow). We compute the cumulative abnormal returns and flows for this style benchmark. Panel A presents the cumulative excess returns and flows to closing ETFs in an event-study framework. Panel B presents cross-sectional means of time-series daily averages of flows, returns, volume, premium/discount, and spread from one year before to the month after closing.

**Table 6: Fees charged by closing ETFs**

Time-series averages one year before to one month after the announcement date						
				<i>t-statistics</i>		
	Before	After	Difference	Before	After	Difference
Management fees (%)	0.561	0.562	0.002	46.64	47.72	-0.95
Management fees (\$ million)	13.4	11.9	-1.51	5.33	4.36	-2.08
Other expenses (%)	1.28	1.39	0.12	9.69	10.48	1.22
Expense ratio (%)	0.634	0.624	-0.011	40.19	40.84	2.32

Note: This table presents the average management fees, other expenses, and the net expense ratio for closing ETFs. An investment manager charges management fees for managing ETF's investment portfolio, typically expressed as a percentage of the ETF's assets under management (AUM). The other expenses include custodial expenses, legal expenses, accounting expenses, transfer agent expenses, and other administrative expenses. These expenses are not included in the management fees. The net expense ratio is the amount an investor pays after accounting for the impact of reimbursements and contractual waivers. We obtain the above fees from the ETF Global database.



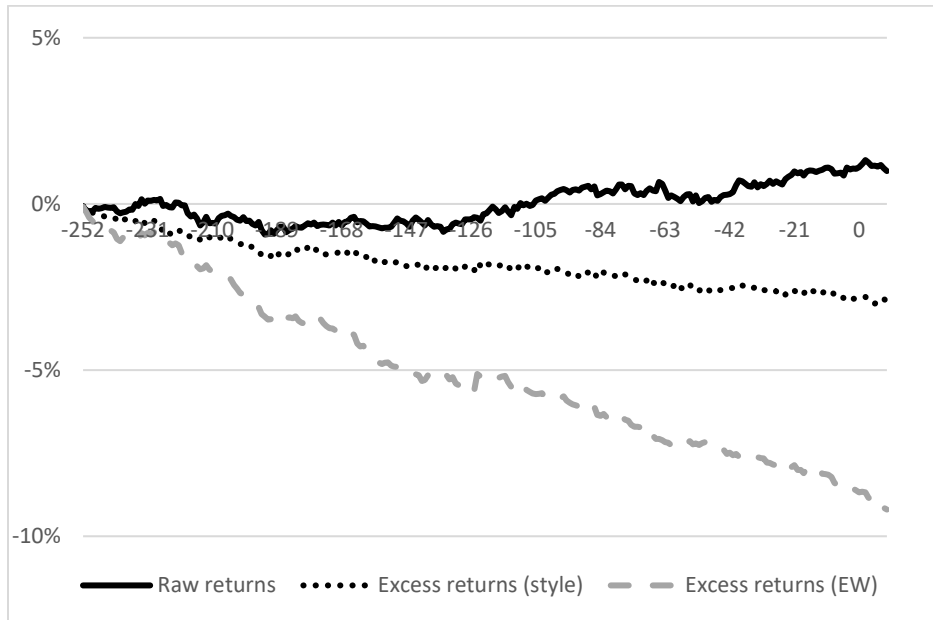
**Table 7: Cumulative excess flows and excess returns earned by ETFs on the TNA ratio**

AUM ratio quintile	-12 to -10	-9 to -7	-6 to -4	-3 to -1	-1 to 0	0 to 1	1 to 2
Panel A: Cumulative excess flows							
Low	-1.79%	-7.80%	-1.95%	0.14%	-2.33%	0.29%	0.28%
	(-0.64)	(-2.56)	(-0.64)	(0.08)	(-1.70)	(0.14)	(0.63)
Q2	4.847%	-0.560%	-5.46%	0.32%	1.73%	-0.58%	-3.26%
	(1.07)	(-0.15)	(-2.78)	(0.16)	(0.72)	(-0.32)	(-1.89)
Q3	5.23%	3.17%	4.65%	-2.02%	0.17%	-2.47%	-5.41%
	(1.37)	(0.70)	(1.30)	(-0.97)	(0.13)	(-1.49)	(-1.95)
Q4	1.21%	-1.86%	4.01%	-0.06%	0.52%	-3.78%	-6.70%
	(0.58)	(-0.64)	(0.71)	(-0.03)	(0.48)	(-2.16)	(-2.40)
High	2.18%	15.58%	-4.79%	0.58%	-1.62%	-5.10%	-11.14%
	(0.53)	(1.07)	(-2.55)	(0.12)	(-1.47)	(-3.95)	(-3.75)
Panel B: Cumulative excess returns							
Low	-2.10%	-0.59%	-1.21%	-1.42%	-0.62%	-0.10%	-0.66%
	(-2.98)	(-0.63)	(-1.31)	(-2.43)	(-1.54)	(-0.25)	(-1.64)
Q2	-1.886%	-0.582%	-0.96%	0.38%	-0.19%	-0.38%	0.03%
	(-2.73)	(-0.89)	(-1.52)	(0.83)	(-0.54)	(-1.38)	(0.10)
Q3	-1.38%	-0.46%	0.98%	-0.73%	-0.70%	-0.11%	0.52%
	(-1.96)	(-0.72)	(0.80)	(-1.67)	(-1.97)	(-0.39)	(1.73)
Q4	-1.31%	-1.08%	-0.78%	0.32%	-0.41%	0.46%	-1.07%
	(-1.59)	(-1.31)	(-1.30)	(0.60)	(-0.83)	(0.86)	(-1.57)
High	-1.31%	-0.21%	-0.25%	-0.56%	-0.03%	0.62%	0.14%
	(-1.28)	(-0.26)	(-0.40)	(-1.35)	(-0.10)	(1.65)	(0.49)

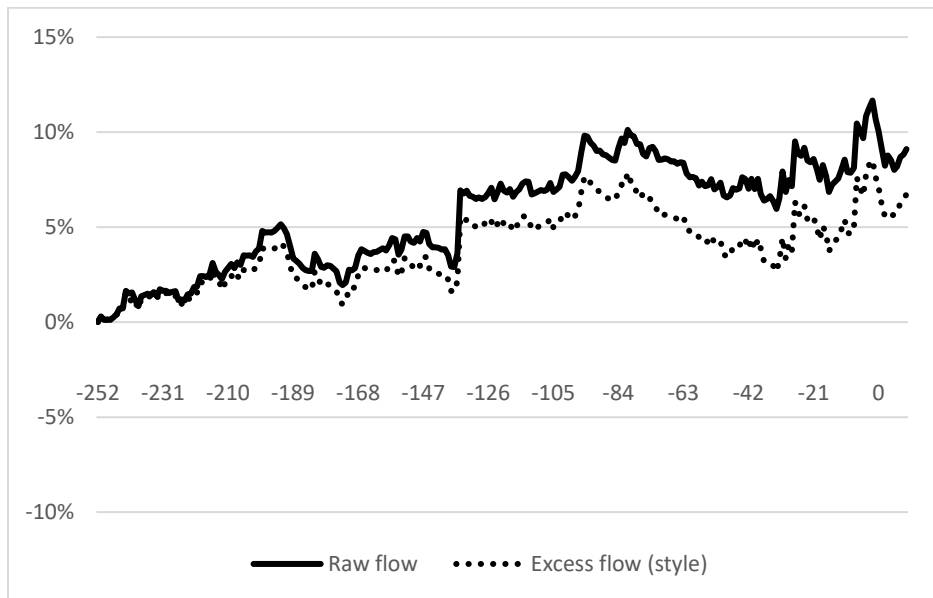
Note: This table presents average cumulative excess flows and returns to the closing ETFs in the year before to two months after the closing announcement. We compute the excess returns and flows with respect to a style benchmark. Specifically, every day, for each closed ETF, we find all other ETFs with the same investment objective and use their mean return (median flow) as the style benchmark return (flow). We then compute the cumulative abnormal returns and flows with respect to this style benchmark. We sort the ETFs based on their total net asset (TNA) ratio one week before the closure announcement, the ratio of the TNA of a closing ETF in a given day to the median TNA of all the other ETFs with the same investment objective as the closing ETF. Panel A reports cumulative excess flows, whereas Panel B reports cumulative excess returns of the closing ETFs.

**Figure 1: ETF cumulative flows and returns around the announcement date**

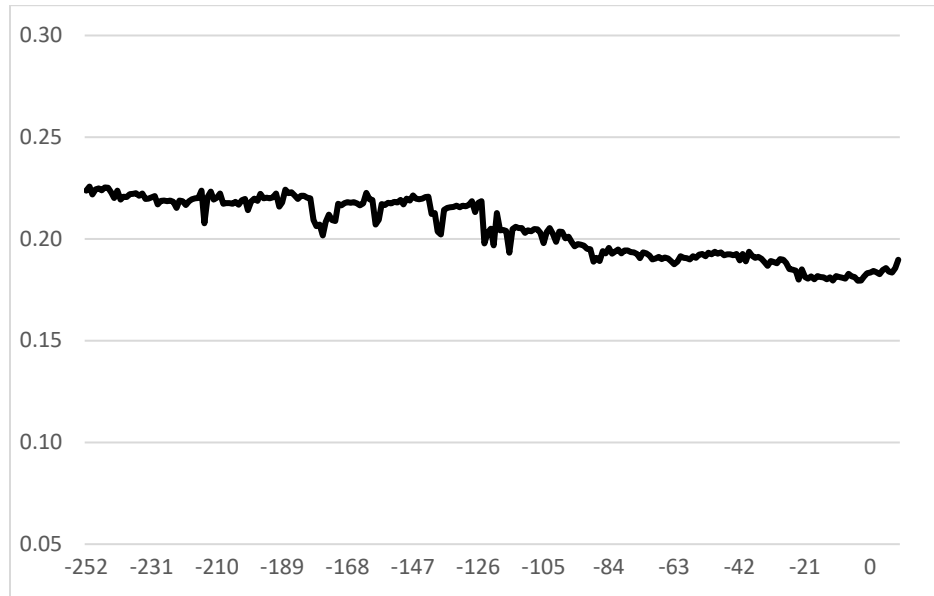
**Panel A: Cumulative returns**



**Panel B: Cumulative flows**



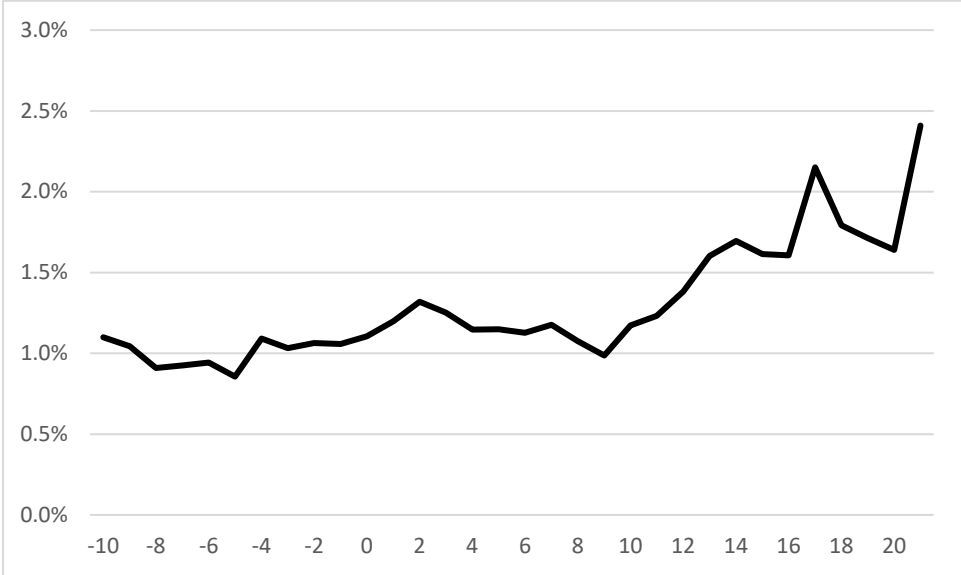
### Panel C: TNA ratio



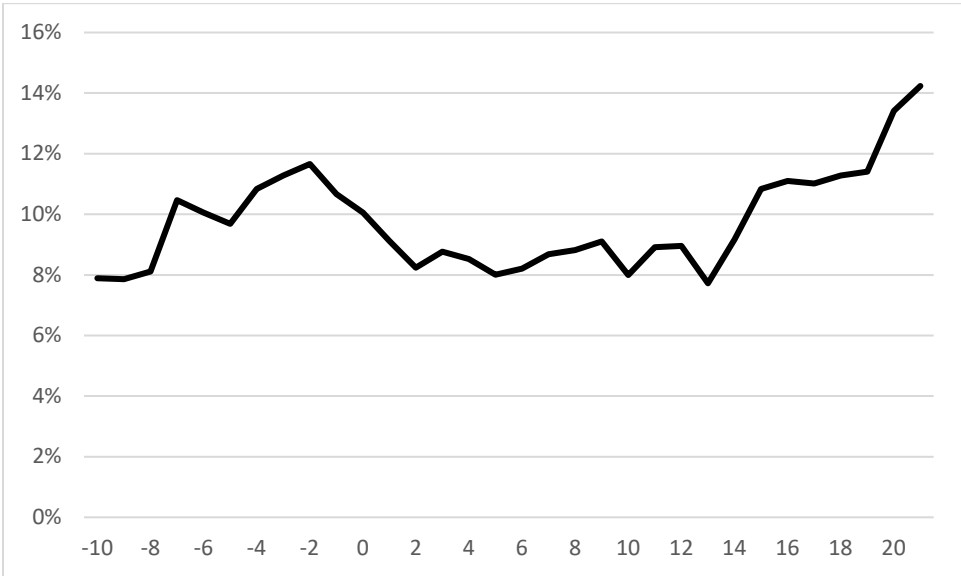
Note: This figure presents the ETF cumulative returns and flows around the closure announcement date. Panel A plots the daily raw and cumulative abnormal returns (style and EW). Panel B plots the daily raw and cumulative abnormal flows (style). Panel C plots the total net asset ratio (TNA) of closing ETFs in event time. We compute the TNA ratio by dividing the TNA of the closing ETF daily by the median TNAs of all other ETFs with the same investment style as the closing ETF.

**Figure 2: ETF characteristics before to after the announcement date**

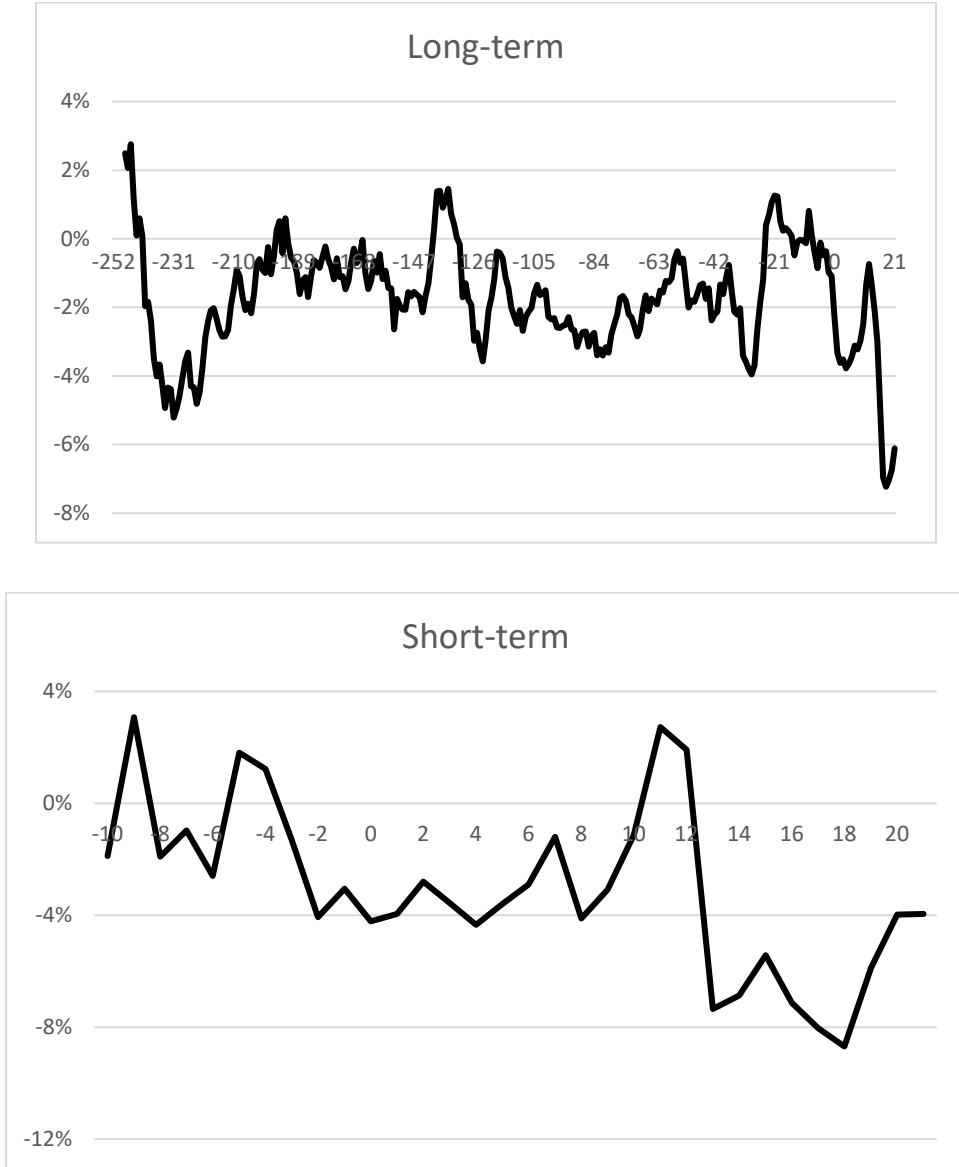
**Panel A: Raw returns**



**Panel B: Raw flows**



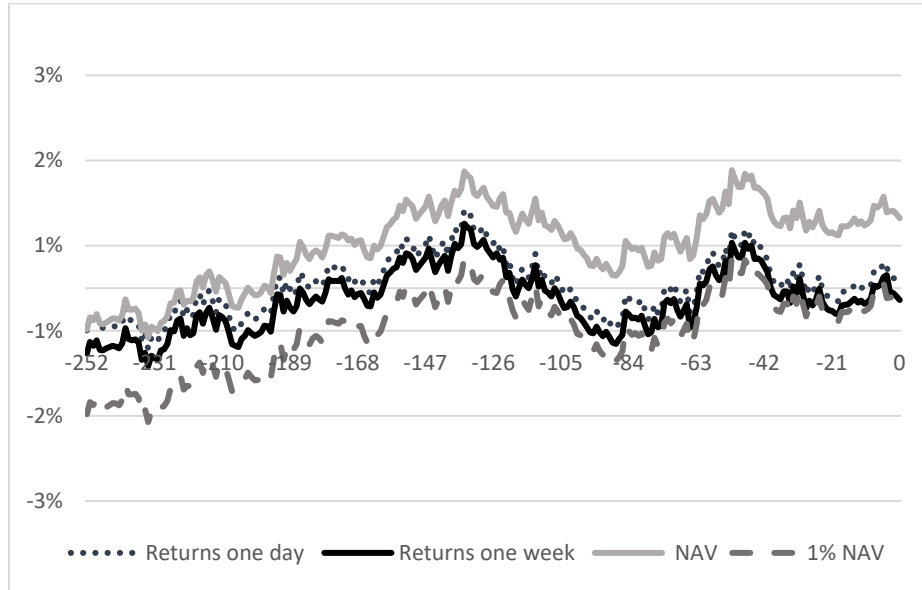
**Panel C: Premium/Discount**



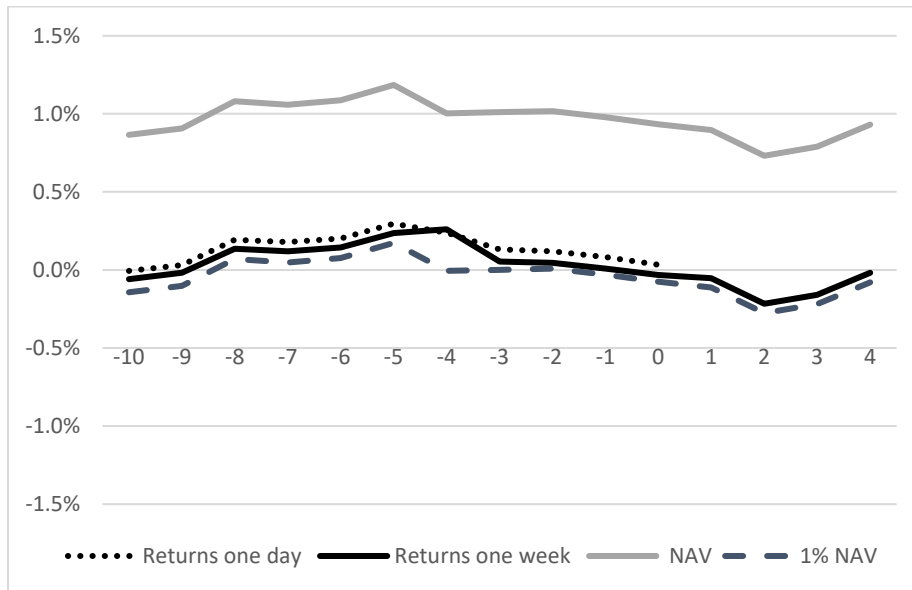
Note: This figure presents the closing ETFs' raw returns and flows and the premium/discount around the closure announcement in an event time. Panel A and B plot the daily raw returns and flows, respectively. Panel C plots the one-week rolling average premium/discount computed as the difference between the closing ETFs' price and net asset value (NAV). If the ETF price is greater than the NAV, then ETF shares are trading at a premium, whereas if it is lower than NAV, then ETFs' shares are trading at a discount. We report the premium/discount over the one year before to one month after the announcement and the premium/discount around the closure date, e.g., ten days before to one month after the announcement.

**Figure 3: ETF closure effects on investors' returns**

**Panel A: The holding period returns one year before the closure announcement**



**Panel B: The holding period returns around the closure announcement**



Note: This figure presents the ETFs' closure on investors' holding period returns. Panel A plots the average returns of an investor that may buy closing ETFs' shares any day before the closure announcement and sells them one day or a week after the closure announcement. It also plots the daily average returns of an investor who waits to receive cash equal to the NAV of its shares rather than sell them. Panel B plots the same daily returns but ten days before to four days after the closure announcement.

## Appendix

### Appendix 1: Characteristics of the closing ETFs over the full sample

	Closing ETFs		Other ETFs	
	25th	75th	25th	75th
ETF one-month-lagged TNA (\$ million)	2.85	14.13	242.89	1336.61
ETF one-month-lagged raw returns (%)	-0.579	0.487	-0.541	0.320
ETF average raw returns months -6 to -1 (%)	-0.027	0.070	-0.021	0.069
Jensen's alpha (style %)	-0.021	0.018	-0.025	0.007
Std. dev. of ETF returns over past 12 months (%)	0.74	1.37	0.50	1.05
Mean one-month-lagged ETF flow (%)	-0.19	0.29	-0.15	0.05
Mean ETF flow months -6 to -1 (%)	-0.07	0.04	-0.004	0.01
One-month-lagged net expense ratio (%)	0.40	0.79	0.40	0.66
One-month-lagged volume (units of one share)	345	3195	119785	439784

	Closing ETFs		Other ETFs	
	Minimum	Maximum	Minimum	Maximum
ETF one-month-lagged TNA (\$ million)	.11	2368.01	2.64	75444.28
ETF one-month-lagged raw returns (%)	-10.34	8.40	-7.86	7.49
ETF average raw returns months -6 to -1 (%)	-1.77	0.66	-0.36	0.304
Jensen's alpha (style %)	-0.78	0.32	-0.137	0.183
Std. dev. of ETF returns over past 12 months (%)	0.04	8.75	0.02	2.42
Mean one-month-lagged ETF flow (%)	-30.50	23.76	-7.20	28.63
Mean ETF flow months -6 to -1 (%)	-1.06	6.16	-0.30	0.81
One-month-lagged net expense ratio (%)	0.05	4.29	0.05	1.06
One-month-lagged volume (units of one share)	1	255806	153	3233343

Note: This table presents the 25th and 75th quantiles, the minimum, and maximum for closing ETFs, and the universe of all other ETFs matched on the closure date. Given this alignment on the closure date, the lagged values represent the ETF characteristics just before the closure month. We define the ETF flow as  $[TNA_t - (1 + r_t) TNA_{t-1}] / (1 + r_t)$ . Jensen's  $\alpha$  is computed using daily returns over 12 months before the closure date. If the ETF does not have 12 months of data, all available data are used for at least nine months.

## Appendix 2: ETF volatility/TNA ratio quintile portfolio returns for the general ETF sample

Volatility	TNA ratio						<i>t</i> -statistics					
	Low	Q2	Q3	Q4	High	Hi-Low	Low	Q2	Q3	Q4	High	Hi-Low
Panel A: Average daily returns												
Low	0.004%	0.02%	0.02%	0.02%	-0.03%	-0.04%	0.84	1.72	1.42	0.79	-1.13	-1.29
Q2	0.006%	0.02%	0.03%	0.02%	-0.05%	-0.05%	1.01	1.69	1.77	1.05	-1.80	-1.57
Q3	0.01%	0.03%	0.02%	0.009%	-0.02%	-0.03%	2.02	2.77	1.21	0.44	-0.60	-0.18
Q4	0.01%	0.02%	0.02%	0.02%	0.10%	0.09%	2.05	2.04	1.02	0.82	2.57	2.14
High	0.004%	0.02%	0.03%	0.03%	0.07%	0.07%	1.31	1.45	1.51	1.30	1.88	1.80
Hi-Low	0.000%	-0.005%	0.005%	0.02%	0.10%	.	0.12	-0.08	0.63	0.59	2.36	.
Panel B: Four-factor $\alpha$ s												
Low	-0.002%	-0.008%	-0.02%	-0.02%	-0.06%	-0.06%	-0.65	-1.10	-1.75	-2.26	-2.31	-2.29
Q2	0.001%	-0.007%	-0.002%	-0.02%	-0.06%	-0.05%	0.24	-1.02	-0.32	-1.61	-2.47	-2.18
Q3	0.006%	0.005%	-0.02%	-0.03%	-0.05%	-0.03%	1.20	0.60	-2.02	-1.79	-1.51	-1.14
Q4	0.002%	-0.003%	-0.02%	-0.03%	0.07%	0.04%	0.52	-0.39	-2.49	-1.56	1.89	1.59
High	-0.002%	-0.009%	-0.01%	-0.01%	0.015%	0.01%	-0.69	-1.21	-1.34	-0.90	0.53	0.52
Hi-Low	-0.002%	-0.002%	0.001%	0.000%	0.07%	.	-0.48	-0.23	0.10	0.02	1.63	.

Note: This table presents average daily returns and Carhart's (1997) four-factor  $\alpha$ s for the 25-quintile portfolios during January 2012 to December 2019-sample period. Every day, starting January 2012, we sort the ETFs using their total net asset (TNA) ratios in that day and their lagged six-month average volatility. We compute the TNA ratio of an ETF by dividing the TNA of the ETF to the median TNA of all other ETFs with the same investment objective. We then construct 25 independent quintile portfolios from the intersection of the lagged volatility and TNA ratio quintile sorts and take their mean every day until the last portfolio formation. Panel A reports the average daily returns and their *t*-statistics. Panel B reports the Carhart four-factor  $\alpha$  estimates obtained by regressing daily portfolio returns, in excess of the risk-free rate, on the four factors.



### Appendix 3: ETF volume/TNA ratio quintile portfolio returns for the general ETF sample

Volume	TNA ratio						<i>t</i> -statistics					
	Low	Q2	Q3	Q4	High	Hi-Low	Low	Q2	Q3	Q4	High	Hi-Low
Panel A: Average daily returns												
Low	0.02%	0.01%	-0.01%	-0.02%	-0.19%	-0.22%	1.57	0.77	-0.47	-0.73	-2.29	-2.64
Q2	0.03%	0.016%	0.003%	-0.02%	-0.04%	-0.06%	2.30	1.05	0.14	-0.71	-0.92	-1.48
Q3	0.02%	0.01%	0.01%	-0.002%	-0.035%	-0.06%	1.18	0.98	0.82	-0.08	-0.79	-0.68
Q4	0.03%	0.02%	0.04%	0.01%	0.07%	0.04%	1.01	1.31	2.28	0.62	2.36	0.66
High	0.10%	0.03%	0.04%	0.02%	0.02%	-0.08%	3.34	1.27	2.14	1.28	1.28	-3.14
Hi-Low	0.08%	0.02%	0.05%	0.05%	0.21%	.	2.47	1.39	2.60	1.61	2.48	.
Panel B: Four-factor $\alpha$ s												
Low	-0.005%	-0.02%	-0.04%	-0.05%	-0.22%	-0.22%	-0.55	-2.24	-2.67	-2.11	-2.32	-2.32
Q2	0.010%	-0.01%	-0.027%	-0.05%	-0.07%	-0.07%	1.22	-1.26	-2.10	-2.33	-1.81	-1.94
Q3	0.004%	-0.01%	-0.020%	-0.04%	-0.06%	-0.041%	0.29	-1.21	-1.59	-2.23	-1.42	-1.04
Q4	-0.004%	-0.006%	0.006%	-0.02%	0.051%	0.03%	-0.25	-0.56	0.61	-1.33	1.90	1.09
High	0.02%	0.001%	0.001%	-0.01%	-0.008%	-0.04%	1.05	0.08	0.08	-1.03	-0.81	-1.92
Hi-Low	0.02%	0.029%	0.04%	0.04%	0.204%	.	1.00	1.74	2.49	1.59	2.13	.

Note: This table presents average daily returns and Carhart's (1997) four-factor  $\alpha$ s for the 25-quintile portfolios during January 2012 to December 2019-sample period. Every day, starting January 2012, we sort the ETFs using their total net asset (TNA) ratios in that day and their lagged six-month average volume. We compute the TNA ratio of an ETF by dividing the TNA of the ETF to the median TNA of all other ETFs with the same investment objective. We then construct 25 independent quintile portfolios from the intersection of the lagged volume and TNA ratio quintile sorts and take their mean every day until the last portfolio formation. Panel A reports the average daily returns and their *t*-statistics. Panel B reports the Carhart four-factor  $\alpha$  estimates obtained by regressing daily portfolio returns, in excess of the risk-free rate, on the four factors.

#### Appendix 4: Cumulative excess flows and excess returns earned by ETFs on TNA ratio

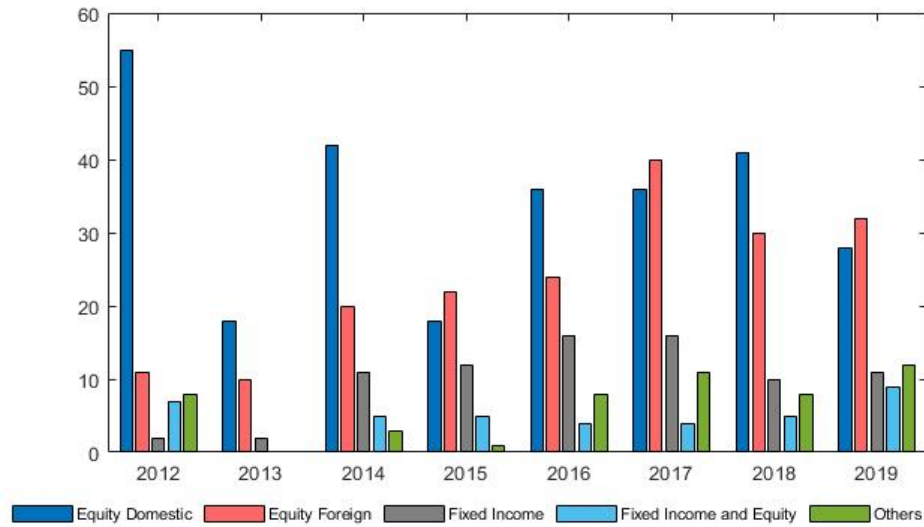
AUM ratio quintile	-12 to -10	-9 to -7	-6 to -4	-3 to -1	-1 to 0	0 to 1	1 to 2
Panel A: Cumulative excess flows							
Low	-0.95%	-6.65%	-2.94%	0.61%	-1.56%	0.22%	-0.15%
	(-0.36)	(-2.67)	(-1.45)	(0.40)	(-1.45)	(0.14)	(-0.44)
Medium	5.991%	1.455%	0.94%	-1.95%	1.07%	-2.68%	-5.89%
	(2.02)	(0.47)	(0.39)	(-1.30)	(0.72)	(-2.20)	(-2.89)
High	1.63%	9.73%	0.25%	0.75%	-0.34%	-4.53%	-10.29%
	(0.64)	(1.13)	(0.07)	(0.24)	(-0.37)	(-3.81)	(-4.27)
Panel B: Cumulative excess returns							
Low	-2.02%	-0.55%	-1.23%	-0.64%	-0.46%	-0.18%	-0.38%
	(-3.67)	(-0.82)	(-1.89)	(-1.57)	(-1.55)	(-0.67)	(-1.35)
Medium	-1.682%	-0.306%	0.04%	-0.55%	-0.46%	0.20%	0.26%
	(-3.11)	(-0.56)	(0.05)	(-1.44)	(-1.58)	(0.59)	(1.03)
High	-1.11%	-0.78%	-0.21%	-0.12%	-0.18%	0.22%	-0.52%
	(-1.49)	(-1.26)	(-0.39)	(-0.31)	(-0.54)	(0.69)	(-1.21)

Note: This table presents average cumulative excess flows and returns to the closing ETFs in the year before to two months after the closing announcement. We compute the excess returns and flows with respect to a style benchmark. Specifically, every day, for each closed ETF, we find all other ETFs with the same investment objective and use their mean return (median flow) as the style benchmark return (flow). We then compute the cumulative abnormal returns and flows with respect to this style benchmark. We sort the ETFs based on their total net asset (TNA) ratio, the ratio of the TNA of a closing ETF in a given day, to the median TNA of all the other ETFs with the same investment objective as the closing ETF. Panel A reports cumulative excess flows, whereas Panel B reports cumulative excess returns of the closing ETFs.

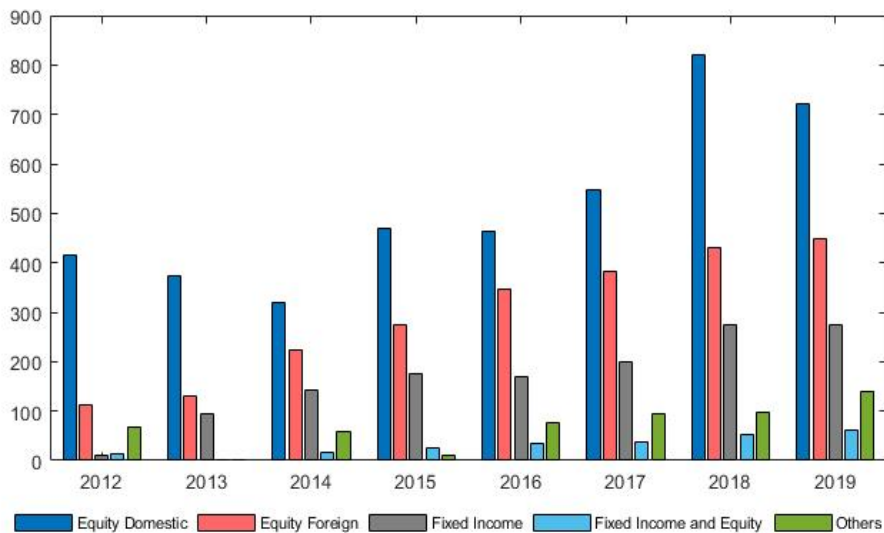
## Supplementary Appendix

**Figure 1: ETFs by investment objective over time**

**Panel A: Closing ETFs by investment objective**



**Panel B: Closing ETFs by investment objective**



Note: This figure presents the closing and other active ETFs in Panels A and B, respectively. In particular, it shows the total number of sample ETFs that closed down and are active between 2012 and 2019 by their investment objectives, as reported by the Center for Research in Security Prices (CRSP) survivorship-bias-free US Mutual Fund Database.

**Table 1: Characteristics of the closing ETFs by investment objective**

	Closing ETFs	Other ETFs			Closing ETFs	Other ETFs		
	Mean	Difference	<i>t-statistics</i>		Median	Difference		Rank test
Panel A: Equity domestic								
ETF one-month-lagged TNA (\$ million)	11.	1113.09	1102.1	3.98	5.26	624.64	619.38	20.14
ETF one-month-lagged raw returns (%)	-0.248	-0.186	0.06	0.53	-0.223	-0.120	0.10	0.46
ETF average raw returns months -6 to -1 (%)	-0.002	0.013	0.01	1.90	0.015	0.020	0.01	0.87
Jensen's alpha (style %)	-0.010	-0.008	0.00	0.29	0.000	0.000	0.00	-1.22
Std. dev. of ETF returns over past 12 months (%)	1.52	1.04	-0.48	-6.51	1.11	0.93	-0.18	-4.73
Mean one-month-lagged ETF flow (%)	0.01	-0.09	-0.10	-0.62	0.03	-0.05	-0.08	-4.90
Mean ETF flow months -6 to -1 (%)	0.11	0.02	-0.10	-2.34	0.00	0.00	0.00	2.26
One-month-lagged net expense ratio (%)	0.67	0.58	-0.09	-3.84	0.65	0.44	-0.21	-1.90
One-month-lagged volume (units of one share)	5069	439951	434882	13.02	1017	277059	276042	19.05
Panel B: Equity foreign								
ETF one-month-lagged TNA (\$ million)	11.1	899.01	887.91	20.83	5.86	792.9	787.04	16.38
ETF one-month-lagged raw returns (%)	-0.008	-0.054	-0.05	-0.50	0.100	0.034	-0.07	-0.74
ETF average raw returns months -6 to -1 (%)	0.042	0.041	0.00	-0.17	0.052	0.048	0.00	-0.19
Jensen's alpha (style %)	-0.005	-0.016	-0.01	-2.01	-0.001	-0.021	-0.02	-3.94
Std. dev. of ETF returns over past 12 months (%)	1.27	0.90	-0.37	-5.49	1.09	0.86	-0.24	-7.22
Mean one-month-lagged ETF flow (%)	0.13	0.16	0.03	0.13	0.00	-0.03	-0.03	-1.40
Mean ETF flow months -6 to -1 (%)	0.08	0.02	-0.06	-1.43	0.00	0.00	0.01	2.64
One-month-lagged net expense ratio (%)	0.56	0.51	-0.05	-3.38	0.50	0.50	-0.01	-2.10
One-month-lagged volume (units of one share)	2862	297316	294454	15.27	864	245744	244880	16.09
Panel C: Fixed income								
ETF one-month-lagged TNA (\$ million)	94.87	1068.65	973.79	12.15	14.54	1011.28	996.74	10.10
ETF one-month-lagged raw returns (%)	-0.007	-0.046	-0.04	-0.62	-0.040	-0.021	0.02	0.14
ETF average raw returns months -6 to -1 (%)	0.013	0.014	0.00	0.16	0.006	0.016	0.01	0.66
Jensen's alpha (style %)	0.002	0.005	0.00	1.07	0.001	0.005	0.00	1.68
Std. dev. of ETF returns over past 12 months (%)	0.49	0.19	-0.30	-7.20	0.40	0.16	-0.24	-5.80
Mean one-month-lagged ETF flow (%)	-0.26	0.17	0.43	1.31	0.01	-0.01	-0.02	-0.63
Mean ETF flow months -6 to -1 (%)	0.06	0.02	-0.04	-0.49	-0.01	0.00	0.01	5.21
One-month-lagged net expense ratio (%)	0.41	0.36	-0.04	-1.58	0.41	0.44	0.03	-0.04
One-month-lagged volume (units of one share)	14001	216957	202956	9.45	2381	165481	163101	9.53

**Table 1 (continued): Characteristics of the closing ETFs by investment objective**

	Closing ETFs	Other ETFs			Closing ETFs	Other ETFs		
	Mean		Difference	<i>t-</i> <i>statistics</i>	Median		Difference	Rank test
Panel D: Fixed income and equity								
ETF one-month-lagged TNA (\$ million)	13.69	184.49	170.8	16.80	10.23	193.49	183.26	7.55
ETF one-month-lagged raw returns (%)	0.186	-0.350	-0.54	-3.39	0.361	-0.306	-0.67	-3.65
ETF average raw returns months -6 to -1 (%)	0.021	-0.017	-0.04	-2.89	0.026	-0.003	-0.03	-2.61
Jensen's alpha (style %)	0.002	-0.012	-0.01	-1.85	0.001	-0.012	-0.01	-1.85
Std. dev. of ETF returns over past 12 months (%)	1.03	0.43	-0.60	-4.90	0.85	0.43	-0.42	-5.16
Mean one-month-lagged ETF flow (%)	0.03	-0.17	-0.20	-1.10	-0.03	-0.07	-0.04	-0.71
Mean ETF flow months -6 to -1 (%)	-0.06	0.06	0.12	2.72	0.00	0.00	0.00	2.51
One-month-lagged net expense ratio (%)	0.81	0.66	-0.15	-2.49	0.71	0.66	-0.05	-2.14
One-month-lagged volume (units of one share)	3360	152343	148984	13.30	1024	115965	114941	7.39
Panel E: Others								
ETF one-month-lagged TNA (\$ million)	6.01	544.35	538.34	8.33	4.27	490.67	486.4	8.27
ETF one-month-lagged raw returns (%)	0.080	0.006	-0.07	-0.55	0.157	0.027	-0.13	-0.61
ETF average raw returns months -6 to -1 (%)	0.029	0.021	-0.01	-0.31	0.025	0.024	0.00	-0.17
Jensen's alpha (style %)	-0.023	-0.005	0.02	0.83	-0.003	0.000	0.00	0.26
Std. dev. of ETF returns over past 12 months (%)	1.46	0.53	-0.92	-3.82	0.90	0.51	-0.39	-4.33
Mean one-month-lagged ETF flow (%)	-0.03	-0.10	-0.06	-0.64	0.02	-0.06	-0.08	-1.91
Mean ETF flow months -6 to -1 (%)	-0.03	0.00	0.03	0.37	0.00	0.00	0.00	1.62
One-month-lagged net expense ratio (%)	0.73	0.80	0.06	0.85	0.65	0.87	0.22	3.27
One-month-lagged volume (units of one share)	4385	304677	300292	9.30	839	277284	276445	7.78

Note: This table compares the mean and median for closing ETFs with those for the universe of all other ETFs, matched on closure date by investment objectives. Given this alignment on the closure date, the lagged values represent the ETF characteristics just before the closure month. We define the ETF flow as  $[TNA_t - (1 + r_t) TNA_{t-1}] / (1 + r_t) TNA_{t-1}$ . Jensen's  $\alpha$  is computed using daily returns over 12 months before the closure date. If the ETF does not have 12 months of data, all available data are used for at least nine months. To examine how significantly different the mean and median of these variables are, we report the *t*-test and Wilcoxon rank test, respectively.