Do ETFs Have a Bright Side?
Primary Market Activity of Authorized Participants and Price Discovery

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ABSTRACT

Prevailing empirical evidence shows ETF ownership impairs price informativeness. The migration of individual investors from stock to ETF ownership, however, simply shifts the secondary market venue for noise trading. We define the liquidity impact of the primary market activities of APs, $PMLIQ$, as the dollar volume of purchases or sales necessary to maintain an orderly market in ETF shares. We show $PMLIQ$ creates space for acquiring and trading on firm-specific information and more significantly on stocks with high ETF ownership concentration. Future excess returns and cumulative abnormal returns around earnings announcements are higher on stocks where $PMLIQ$ are more significant.

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SPDR S&P 500 ETF Trust (SPY), first introduced in 1993 by State Street Global Advisors, is the oldest and largest U.S. listed and domiciled equity Exchange Traded Fund (ETF) as of 2019. Between 1993 and August 2019, assets under management (AUM) by index funds which track broad US equity indexes grew to $4.27 trillion, compared to only $4.25 trillion in U.S. listed actively managed equity funds.[1] ETF listing exchanges calculate indicative NAVs at 15-second intervals during exchange trading hours, and ETF shares trade continuously during exchange hours. The value of ETF shares traded is roughly 28% of the aggregate value of shares traded in U.S. exchanges (Boroujerdi and Fogertey, 2015; and Pisani, 2015).

Current empirical studies document the adverse impact of ETF ownership on price discovery and informativeness. The attendant reduction in the number of stock shares available for trade from ETF ownership deters informed trading on idiosyncratic firm-specific information and impairs price discovery (Israeli, Lee, and Shridharan, 2017; Ben-David, Franzoni, and Moussawi, 2018; Madhavan and Sobcyzk, 2014).[2]

Theory, however, suggests that ETFs represent an important innovation. Composite securities like ETFs are not redundant when uninformed investors have to trade to meet immediate liquidity needs, but prices are not fully revealing when some investors are informed. To avoid trading against informed investors, uninformed investors will choose to meet their liquidity needs through ETF shares rather than individual stock ownership (Gorton and Pennachi, 1993; and Subrahmanyam, 1991). The migration of individual investors from stocks to ETFs represents a shift in the secondary market venue for liquidity (noise) trading.[3] The volatility in ETF share prices sparked by liquidity (noise) trading in ETF shares catalyzes the primary market activities of APs. The exchanges of ETF and stock shares necessary to maintain orderly markets in ETF shares channel liquidity onto stocks underlying ETFs that advance trading on idiosyncratic firm-specific information by active investors.

[1] *WSJ* "Where ETFs are headed in 2019" reports that $295 billion flowed into US domiciled ETFs in 2018 alone; 66.8% into stock funds and the remainder to fixed-income funds. 0.3% flowed out of alternative investment funds. *WSJ* "Index Funds Are the New Kings of Wall Street" reports that as of August 2019, assets under management in index equity funds with $4.27 trillion exceed actively managed equity funds with $4.25 trillion. https://www.wsj.com/articles/index-funds-are-the-new-kings-of-wall-street-11568799004?mod=searchresults&page=1&pos=4.

[2] The migration of noise trading to ETFs raises the cost of executing trades in stock shares. For market makers, a decline in the number of stock shares available for trade increases the search costs of matching buyers and sellers and buying into or selling from inventory carries the risk of trading against informed investors.

[3] As Stambaugh (2014) observes, high noise trading implies a high capacity for profitable active management. The conjunction of noise trading and active asset management will enhance information efficiency. Stock mispricing from noise-trading by individual investors sparked a growth in actively managed mutual funds (Pastor, Stambaugh and Taylor, 2015). The decline in noise trading from contractions in individual ownership of stocks and correction in stock mispricing from informed trading by active asset managers, however, intensified competition for assets among active asset managers. The popularity of ETFs mirrors a shift by retail investors away from active stock managed to passive "indexed" investments prompted by lower management fees and increasing interest in thematic investment strategies.

Moreover, as Cong and Xu (2019) and Glosten, Nallareddy, and Zou (2019) point out, ETFs are well-diversified portfolios whose returns largely reflect systematic market rather than idiosyncratic firm-specific factors. For uninformed investors, ETFs expand investment opportunities when transactions and holding costs would otherwise limit stock ownership to transparent and liquid stocks. At the same time and more crucially, ETFs make informed market factor investment strategies by sophisticated asset managers at low trading cost feasible. Glosten, Nallareddy, and Zou (2019) find an increase in ETF ownership allows systematic market-wide information to be incorporated into stock prices more quickly which attenuates post-earnings announcement drifts in cumulative abnormal returns. ETF share prices will reflect the speculative trading of market factor informed institutional investors as well as liquidity (noise) trading of uninformed individual investors.

Herein lies the research question of interest in our study. Through the exchanges of ETF and stock shares, do the primary activities of APs enhance price discovery? We recognize that in contrast to futures and other derivative contracts, trading in ETF shares do not represent side bets on the underlying stocks in a completely segmented market. ETFs contract the supply of stock shares available for trade. At the end of 2019, ETFs own an average 11.65% of common stock outstanding almost at par with actively managed mutual fund average stock ownership of 12.67%.

APs act as market makers in ETF shares. To maintain an orderly market in ETF shares, APs adjust the secondary market liquidity of ETF shares in response to abnormally high or low liquidity (noise) trading in ETF shares through the creation or redemption of ETF shares. An increase (decrease) in the supply of ETF shares from the primary activity of APs will correspondingly increase (decrease) the demand for and thereby the secondary market liquidity of underlying stocks.

We introduce a new measure for the liquidity provided by the primary market activities of APs, $PMLIQ$, in their roles as market makers. Abnormally high (low) liquidity (noise) trading in ETFs will spark volatility in ETF share prices that result in large positive (negative) percentage deviations in ETF imputed from concurrent stock price. Because multiple ETFs own stocks in common and stock ownership differs across ETFs, we estimate the percentage deviations in ETF imputed from concurrent stock price as the product of the monthly average daily absolute percentage deviation in ETF share price from NAV of ETFs who own the same stock and their relative ETF ownership of the stock summed across ETFs each month. Relative ETF ownership on an underlying stock is simply the number of shares owned by an ETF expressed as a fraction of the total number of shares owned by all ETFs.

We compute the dollar volume of purchases (sales) of underlying stocks required to raise (lower) the number of ETF shares from monthly changes in stockholdings of ETFs who own the same stock. $PMLIQ$ is high when the dollar volumes of underlying stocks exchanged for ETF shares to manage volatility in ETF share prices from liquidity (noise) trading by uninformed investors are small. We find that $PMLIQ$ increases on stocks with high ETF stock ownership concentration. APs appear more willing to engage in primary market activities in ETFs when the underlying stocks are not widely held across ETFs, more opaque and illiquid. The risks of trading against factor informed speculators in ETF shares when percentage deviations of ETF imputed from concurrent stock price are high, however, limits the $PMLIQ$ that APs are willing to provide to the secondary market for underlying stock shares.

Our study makes two important contributions to the literature. Our study is the first, to the best of our knowledge, to disentangle two separate and distinct effects of ETFs on the secondary market liquidity of underlying stock shares. First, from the primary market activities of APs in response to liquidity (noise) trading in ETF shares, and second, from the liquidity buffer effects of stock share lockups concomitant with ETF ownership. More significantly, taking ETF ownership, stock illiquidity as well as speculation by market factor informed investors, we show the primary market activities of APs in ETFs enhance price discovery and informativeness.

We find that $PMLIQ$ stimulates investment in the acquisition and trade on idiosyncratic firm-specific information. Like ETF ownership, $PMLIQ$ is persistent. Sorting stocks into quintile portfolios by ETF ownership and $PMLIQ$ each month, the likelihood that stocks in the top quintiles of ETF ownership and $PMLIQ$ remain in the top quintiles in the subsequent month are 94.69% and 78.85% respectively.

Active investors in stocks where $PMLIQ$ is high are better informed about future stock returns. High levels of $PMLIQ$ forecast higher future excess stock returns and over longer periods. Sorting stocks by $PMLIQ$ into quintile portfolios each month, we show that compared to stocks in the bottom $PMLIQ$ quintile portfolio, stocks in the top $PMLIQ$ quintile portfolio yield higher average lead one-month Carhart (1997) 4-factor alpha of 0.442%, Fama-French (2015) 5-factor alpha of 0.635%, and DGTW excess return of 0.422%. Across quintile portfolios, $PMLIQ$ has a more significant impact on average excess returns when ETF stock ownership concentration is high. High-low quintile $PMLIQ$ portfolios yield lead one-month 4-factor alpha of 0.632%, 5-factor alpha of 0.934%, and DGTW excess return of 0.612% when ETF stock ownership is above median compared to 0.552%, 0.492%,

and 0.234% when ETF stock ownership concentration is below median. Moreover, when ETF stock ownership concentration is below median, high-low quintile portfolio returns stem primarily from the long side dominated by high $PMLIQ$ quintile portfolios. Average high-low quintile portfolio returns decline in magnitude but remain strong through lead four months and are more persistent when ETF ownership concentration is high.

To make changes in $PMLIQ$ comparable across stocks and months in our regression analyses, we assign stocks each month into 100 portfolios with percentile ranks that range from a low of 0.01 to a high of 1.00. In sorting, low, median, and high $PMLIQ$ quintile portfolios represent stocks with percentile ranks 0.01 to 0.20, 0.41 to 0.60, and 0.81 to 1.00, respectively. A natural log transform corrects for a considerable left skew in the sample distribution of $PMLIQ$. For brevity, we refer to a 0.40 change in percentile rank, which is approximately one standard deviation in $ln(PMLIQ)$, as simply a one standard deviation increase in $PMLIQ$.

Two-way stock and month fixed effect regressions confirm stocks where $PMLIQ$ is high exhibit greater excess returns controlling for ETF ownership, stock illiquidity, and factor informed trading. A one standard deviation increase in $PMLIQ$ predicts an average lead one-month rise in 4-factor alpha of 0.561%, 5-factor alpha of 0.576%, and DGTW excess return of 0.574%. We confirm our finding that the impact of $PMLIQ$ is greater when ETF ownership concentration is high. Compared to below median $PMLIQ$ portfolios, average lead one-month 4-factor alpha, 5-factor alpha, and DGTW excess return are higher on above median $PMLIQ$ portfolios by 0.480%, 0.471% and 0.398% when ETF stock ownership concentration is above median, and by 0.217%, 0.174%, and 0.223% when ETF stock ownership concentration is below median. Average excess returns decline in magnitude by strongly persist through lead 4 months.

Because the idiosyncratic firm-specific information of informed investors is made public through earnings disclosures, we also examine cumulative abnormal returns (CAR) around earnings announcements. We find cumulative abnormal returns in the 5-day window around earnings announcement date and in the 60-day post-earnings announcement period are greater when $PMLIQ$ is high. Controlling for ETF stock ownership, stock illiquidity, and factor informed trading, a one standard deviation increase in $PMLIQ$ predicts a higher average $CAR(-2,+2)$ and $CAR(3,60)$ of 0.233% and 0.872%.

In robustness tests, we confirm the primary market activities of APs address liquidity in secondary markets for ETF shares when noise trading in ETF shares is abnormal. The primary market activities

of APs make secondary markets in stocks underlying ETFs more resilient. The decrease in stock return volatility and lower likelihood of trading against informed investors reduces Corwin-Schultz (2012) bid-ask spreads. Controlling for ETF ownership, stock illiquidity, and factor informed trading, two-way stock and month fixed effects regressions show a one standard deviation increase in $PMLIQ$ reduces average stock return volatility by 1.05% and average spread by 2.53%. The decrease in stock return volatility from higher $PMLIQ$ are unaffected by ETF ownership concentration. While the decrease in Corwin-Schultz spread from higher $PMLIQ$ stronger for stocks with lower ETF ownership concentration.

We verify the primary market activities of APs in response to the volatility in ETF share prices from liquidity (noise) trading in ETF shares allows value-relevant idiosyncratic firm-specific information to be incorporated onto underlying stocks more promptly. A one standard deviation increase in $PMLIQ$ reduces average mean reversion in stock returns by 3.47%.

Consistent with higher idiosyncratic firm-specific information efficiency, we also corroborate that returns on stocks underlying ETFs exhibit lower drift and are less correlated with market returns when $PMLIQ$ is high. A one standard deviation increase in $PMLIQ$ lowers average market return beta on a Carhart (1997) 4-factor model by 10.05% and on a Fama-French (2015) 5-factor model by 10.66%.

Cong and Xu (2019) comment that "after introducing composite securities, asset prices reflect more systematic information and less asset specific information. Because market makers know factor speculator now fully exploit his information advantage, set prices more sensitive to the composite security orders." Indeed, using percentage deviations in ETF imputed from concurrent stock prices as proxy, we find that factor informed trading impounds market-wide information into current stock prices more quickly. Market return betas are higher and future excess returns are lower when factor informed trading is high. Controlling for ETF ownership and stock illiquidity, a one standard deviation rise in factor informed trading increases the average lead one-month 4-factor market beta by 3.28% and 5-factor beta by 3.19%. At the same time, a rise in factor informed trading predicts a lower average lead one-month 4-factor alpha of 0.128%, 5-factor alpha of 0.125%, and DGTW excess return of 0.114%.

Further, we confirm Glosten et al. (2019) finding that informed trading on systematic market factors attenuate post-earnings announcement drifts in CAR. A one standard deviation rise in factor informed trading on ETF shares decreases $CAR(3,60)$ by 0.136%. Market makers thus increase spread on stocks underlying ETFs to protect against informed trading on systematic market factors. A one

standard deviation rise in factor informed trading increases average spread by 0.31%.

On underlying stocks, share lockup from higher ETF ownership impairs price discovery. Two-way stock and month fixed effects regressions show a one standard deviation rise in ETF ownership decreases average lead one-month 4-factor alpha by 0.432%, 5-factor alpha by 0.403% and DGTW excess return by 0.423%. The decline in average excess returns diminishes in magnitude but remains strongly significant through lead four months. Moreover, although the impact of ETF ownership on $CAR(-2,+2)$ is insignificant, $CAR(3,60)$ is significantly lower by 0.698%. A one standard deviation increase in ETF ownership increases average stock return volatility by 3.20%, and consistent with lower idiosyncratic firm-specific information efficiency, increases average market return beta on a 4-factor and 5-factor model by 5.81% and 5.48%.

II. Empirical Hypotheses and Data Constructs

A. Literature Review

Current empirical studies focus on the impact of ETF ownership on price discovery. Israeli, Lee, and Sridharan (2017) find that trading costs and stock return synchronicity increase with higher ETF ownership. Future earnings are more markedly discounted, and stock returns are more correlated with market returns when ETF ownership is high. The intraday liquidity, convenience, and low transactions cost of ETF shares foster liquidity (noise) trading by uninformed investors. Liquidity and turnover are higher and bid-ask spreads are lower on ETFs than underlying stocks (Ben-David, Franzoni, and Moussawi, 2018; Madhavan and Sobcyzk, 2014), and short-run reversals in price changes from daily ETF fund flows attest that trading in ETF shares do not reflect fundamental information. In addition to uninformed investors, Ben-David et al. (2018) argues the liquidity of ETFs attract short-horizon institutional investors as well. They conjecture the higher churn on ETF held stocks in the portfolios of short-horizon institutional investors impact stock prices that catalyze deviations in ETF share prices from NAV. The arbitrage trading by APs and other high-frequency traders that ensue increase intraday return volatility. In this study, we focus instead on the liquidity provided APs in the secondary market for underlying stocks through their primary market activities as market makers to manage volatility in ETF share prices from the noise trading of uninformed investors.

< Insert Figure I here. >

B. Hypotheses

As shown in Figure I, ETFs create liquidity buffers which insulate secondary markets in stocks underlying ETFs from noise trading by uninformed retail investors who are attracted by and migrate

to ETFs. The magnitude of the deviation in ETF imputed from concurrent stock price signals abnormally high or low liquidity (noise) trading in ETF shares that stimulate $PMLIQ$. To maintain an orderly market in ETF shares, the primary activities of APs to manage volatility in ETF share prices from liquidity (noise) trading in ETF shares changes the demand for and thereby secondary market liquidity of stocks underlying ETFs.

Liquidity Buffer

Shares of ETF held stocks are held in trust. The contraction in the supply of shares available for trading will reduce liquidity and increase return volatility in secondary markets. The added search costs of matching buyers and sellers, higher likelihood of trading against informed investors, and increased risk of holding inventory from price delays in the assimilation of value-relevant information will induce market makers to increase spread on stocks underlying ETFs. Higher price impact (transaction cost) of trading will discourage acquisition and trade on idiosyncratic firm-specific information. Correlations in stock and market returns will increase with ETF ownership. We conjecture that stock price will be less informative about idiosyncratic firm-specific factors when ETF ownership is high.

Liquidity Channel

The migration of individual investors from underlying stocks to ETFs by and large represents a shift in the secondary market venue for noise trading. We conjecture that in order to maintain an orderly market in ETF shares, APs use the creation and redemption of ETF shares in the primary market to manage the volatility in ETF share prices from liquidity (noise) trading in ETF shares. The diffusion of uncorrelated liquidity demand shocks in ETF shares onto underlying stocks through the primary market activities of APs increases the secondary market liquidity and decreases the return volatility of underlying stocks.[4] The increase in liquidity and decrease in return volatility mitigates the cost of trading against informed investors and risk of holding inventory. Market makers will decrease spread in stocks underlying ETFs. Lower trading costs will encourage acquisition and trade on idiosyncratic firm-specific information. Correlation of stock with market returns will be lower, and stock price will be more informative about idiosyncratic firm-specific factors when $PMLIQ$ is high.

It is our view that as market makers, the primary activities of APs are motivated by the liquidity requirements for maintaining orderly markets in ETF shares. In contrast Ben-David et al. (2014) argue that short-horizon institutional investors are attracted to ETF held stocks. Their high stock churn

[4]Additionally, when uninformed investors can choose from many competing ETFs, systematic trading in ETF shares from correlated demand shocks declines. Deviations in ETF share price from NAV will be largely idiosyncratic.

catalyze deviations in ETF imputed from concurrent stock prices. Arbitrage trading by APs and other high frequency traders that ensue increase the intraday volatility in returns on underlying stocks.[5] Wermers and Xue (2015) examine the lead-lag relationship between ETF shares and their underlying cash indices. They find the impact of intraday noise trading in ETF shares on the future volatility in the underlying cash index decays within a few minutes but the intraday informed trading in ETF shares tend to persist.[6] A finding that is consistent with the Cong et al. (2019) and Glosten et al. (2019) thesis that factor informed trading in ETF shares will incorporate systematic market-wide information into stock prices more promptly.

Moreover, we point out that APs do not receive any compensation from ETF fund sponsors and have no legal obligation to create or redeem ETF shares.[7] APs derive their compensation acting as broker-dealers in ETF shares and on a typical day will respond to premiums or discounts in ETF share price from NAV either through the purchase and sale of ETF shares from inventory or through short-term long-short positions in ETF shares and derivative contracts. APs will manage their inventories by creating or redeeming ETF shares only when it is in their economic interest given market conditions.

On average, daily trading volume in ETF shares is 4 times the volume of ETF shares created or redeemed, and on a given day, there is no creation or redemption of ETF shares by APs in 91% of domestic equity ETFs. Average daily trading in domestic equity ETF shares in secondary markets represent 91% of total primary and secondary market activity. Most domestic equity ETFs and ETFs with more than $790 million in AUM do not have significant daily creations or redemptions of ETF shares because APs are also registered market makers. Further, there are a large number of broker-dealers and other market makers who are not APs but provide two-sided quotes on ETF shares and

[5]Using Ancerno data, they find that short-horizon institutional investors have a relatively higher churn on ETF stocks in their portfolios which they conjecture induce arbitrage opportunities. Deviations in ETF share prices from NAV spark arbitrage trading by APs and other high frequency traders (hedge funds) which increase intraday stock return volatility and introduces an undiversifiable risk that raises required returns.

[6]Ben-David et al. (2014) find that daily ETF fund flows exhibit momentum and the price impact of ETF fund flows on underlying stocks reverses over the next 40 days consistent with liquidity (noise) trading in ETF shares. Higher mean reversion in stock returns with increased ETF ownership suggests lowered price efficiency from the migration of liquidity (noise) trading to ETFs.

Similarly, in unreported results, Box, Davis, Evans, and Lynch (2020) also find the divergence in trading volume between ETFs and their underlying stocks to be the best predictor of future daily changes in the number of ETF shares outstanding. Consistent with sentiment-based noise trading, daily changes in outstanding ETF shares exhibit momentum, that is, are highly persistent and the strongest predictor is the daily change in ETF shares outstanding in the prior week.

Box et al. (2020) find, however, the absolute sum of intraday deviations of ETF share from cash index is a weak predictor of future daily changes in ETF shares outstanding. In our subsequent analyses, we show the creation and redemption of ETF shares in the primary market is motivated by the desire of APs as market markets to provide the liquidity necessary to maintain an orderly market in ETF shares rather than to arbitrage deviations in ETF share prices from NAV.

[7]See Rochelle Antoniewicz and Jane Heinrichs, Investment Company Institute, The Role and Activities of Authorized Participants of Exchange-Traded Funds (Mar. 2015), available at http://www.ici.org/pdf/ppr_15_aps_etfs.pdf.

augment the liquidity of ETF shares traded on secondary markets. As proxies for the creation and redemption of ETF shares, daily changes in ETF shares outstanding (fund flows) will considerably overstate the primary market activities of APs, particularly in smaller ETFs where the number of active APs involved in at least one transaction involving the creation or redemption of ETF shares over a 6-month period is low.

Further, we conjecture that ETFs attract active investors who choose to become informed about systematic market factors and who exploit their informational advantage by trading in ETFs. With the introduction of composite securities, asset prices will reflect relatively more systematic and less asset specific information because market makers know speculators on systematic market-wide factors will fully exploit their information advantage. Market makers (APs and non-APs) will increase spread to protect against active investors who trade on systematic market-wide factors. Informed trading on systematic market-wide factors will increase volatility and correlation between stock and market returns.

C. ETF Sample

Morningstar Direct℠ is our primary source of ETF holdings data. We identify all U.S. domiciled equity ETFs listed on U.S. stock exchanges with U.S. common stock holdings over the 187-months from June 2004 to December 2019. Morningstar Direct℠ data includes voluntary (monthly) as well as required (quarterly) disclosures of portfolio holdings. Our sample begins in June 2004 to coincide with the U.S. Securities and Exchange Commission (SEC)'s rule change, which for the first time, requires ETF sponsors to report portfolio holdings on a quarterly rather than semiannual basis.[8] Prior to June 2004, most ETF sponsors reported quarterly holdings. The ruling requiring quarterly reporting prompted most ETF sponsors to report not just quarterly but monthly. Starting in June 2004, Morningstar Direct℠ reports most ETF stock holdings data monthly in our Morningstar sample of funds which ends December 2019. We use ETF CUSIPs to match our sample of ETFs to the CRSP mutual fund holdings database.

We include sector and international equity ETFs that hold domestic U.S. stocks in our sample but exclude leveraged ETFs and exchange traded notes (ETNs). Leveraged ETFs use futures and other derivatives to achieve leveraged exposure to U.S. equities, and ETNs involve fund sponsor risks that

[8] Under the Investment Company Act of 1940, the SEC adopted a rule in May 2004, SEC File No. S7-51-02 (https://www.sec.gov/rules/final/33-8393.htm#IIB4), which required all registered management investment companies to file a complete schedule of its portfolio holdings on a quarterly basis. Subsequently, SEC File No. S7-08-15 required the reporting and disclosure of information by registered investment companies on a monthly basis effective January 2017 (https://www.sec.gov/rules/final/2016/33-10231.pdf).

render them unsuitable for analysis in this study. To avoid survivorship bias, we allow the entry and exit of ETFs in our sample. Our final sample consists of 1,588 unique ETFs, ranging from 101 in June 2004 to 1,011 in December 2019.[9]

D. Stock Sample

We obtain daily and monthly closing share prices, volume, shares outstanding, returns, and other data on all common stocks in the CRSP database, but retain only those stocks traded on the NYSE, AMEX, or NASDAQ. Consistent with prior literature, we eliminate stocks with excessively low share prices (below $5) or equity market capitalization (less than $10 million at month end).

< Insert Table I here. >

Table I reports summary statistics on the total number of CRSP common stocks traded on the NYSE, AMEX, or NASDAQ, and the number of CRSP stocks that meet our screens on minimum share price and equity market capitalization. Column 2 shows the average number of CRSP stocks decreases by 35.7% from a high of 5,327 to a low of 3,927 over the sample period. Columns 3 and 4 show the average number of CRSP stocks that meet our screen is 82.1% of CRSP stocks. The low percentage of 71.1% in 2009 reflects a decline in share price below $5 and contraction in market capitalization for many firms during the financial crisis. Columns 5 and 6 show the number of stocks owned by ETFs average 3,395 which is 93.5% of our sample of stocks, rising from a low of 86.1% in 2004 to a high of 98.0% in 2015. From 2012 onward, stocks owned by ETFs represent at least 96% of our stock sample.

E. ETF Ownership

We construct a monthly time series of ETF ownership on each stock. In month t, $n_{ij}(t)$ denotes shares of stock i owned by ETF j, and $shrout_i(t)$, the total shares outstanding of stock i. The aggregate ETF ownership of stock i in month t, $own_i^{ETF}(t)$ is:

$$own_i^{ETF}(t) = \sum_j n_{ij}(t)/shrout_i(t) \quad (1)$$

We use a Herfindahl-Hirschman Index (HHI) to describe the concentration of ETF ownership. HHI is computed as the square of relative ETF ownership summed across all ETFs $j \epsilon N$ who own stock i at the end of month t.

$$HHI_i^{ETF}(t) = \sum_{j \epsilon N} \{relown_{ij}^{ETF}(t)\}^2 \quad (2)$$

[9]In Appendix Table AII, we report the top 10 ETF advisory firms by number of funds, the distribution of average fund size (in millions of dollars) and number of unique stocks owned across ETFs over the entire sample period, and for the end (September 2017) and the beginning (June 2004) months.

and relative ETF ownership, $relown_{ij}^{ETF}(t)$, is the number of stock shares owned by an ETF as a percentage of the aggregate number of stock shares owned by ETFs at month end.

$$relown_{ij}^{ETF}(t) = n_{ij}(t)/\sum_{j\epsilon N} n_{ij}(t) \quad (3)$$

A small (high) HHI indicates a diffuse (concentrated) distribution of ETF share ownership in the stock. In each month, dummy variable High HHI equals 1 when ETF ownership concentration in the stock is above median, and 0, otherwise. Similarly, Low HHI dummy equals 1 when ETF ownership concentration in the stock is equal to or below median, and 0, otherwise.

Table I also reports annual averages of monthly ETF ownership on stocks held by ETFs, as well as average quarterly active and index mutual fund ownership on stocks both held and not held by ETFs. We use the CRSP Mutual Funds holdings database to construct stock level mutual fund ownership. Following the literature, for mutual funds with multiple share classes, we ascribe the characteristics of the largest share class to the fund. We eliminate ETFs from mutual funds using an ETF identifier, and separate active from index mutual funds using both an index fund identifier and fund names. Active (index) mutual fund ownership is the aggregate number of shares owned by active (index) mutual funds at the end of quarter expressed as a percent of total shares outstanding for the stock. We use quarter-end active (index) mutual fund ownership for the three months in the quarter.

Column 7 shows the mean ETF ownership of stocks held by ETFs rose markedly from 2.1% to 11.7% concurrent with an increase in the percentage of CRSP stocks held by ETFs from 86.1% to 97.0%. The number and percentage of shares outstanding held by ETFs grew steadily with the large influx of net money flows into ETFs.

Active and index mutual fund ownership of stocks underlying ETFs are reported in Columns 8 and 9, and non-ETF held stocks, in Columns 12 and 13. We draw four observations. First, active mutual funds have significant ownership interests in stocks underlying ETFs, averaging 11.0% over the sample period. Second, among ETF held stocks, active mutual fund ownership grew faster than ETF ownership in the first five years of our sample period reaching a peak of 18.7% in 2009, which is more than three times ETF ownership. Thereafter, active mutual fund ownership declined, and by 2019 active mutual fund ownership of 12.7% is similar to ETF ownership, reflecting a secular shift from active to passive investments. Third, index mutual fund ownership, which average 5.6% over the sample period, also grew steadily from 3.7% at the start to 7.8% at the end of the sample period. Index mutual fund ownership comes close but never exceeds ETF ownership. Fourth, mutual funds also have meaningful ownership interests in non-ETF held stocks. The ownership of non-ETF held

stocks by active and index mutual funds average 2.62% and 0.81% over the sample period, from a high of 3.3% and 1.1% at the start to 6.6% and 2.3% at the end of the sample period. The average number of non-ETF held stocks is 424 over the sample period which exhibits a similar decline from 706 stocks at the start to 266 at the end of the sample period.

F. Liquidity Channel

We introduce a new measure of secondary market liquidity provided by the primary market activities of APs.[10] We define vol_i^{ETF} as the sum of purchases and sales of shares in stock i across contiguous months[11] aggregated across ETFs who own the stock.

$$vol_i^{ETF}(t) = share\ purchases_i(t) + |share\ sales_i(t)| \tag{4}$$

where positive $n_i(t) - n_i(t-1)$ denotes monthly aggregate purchases, and negative $n_i(t) - n_i(t-1)$ denotes monthly aggregate sales, of shares in stock i expressed in millions of shares.[12]

We proxy the volatility in ETF share prices that stem from liquidity (noise) trading in ETF shares, by the absolute percent deviation of ETF imputed from concurrent price on stock i in month t, $|r_{it}^{ETF}|$, computed as the product of the monthly average absolute daily deviation in ETF share price from NAV and relative ETF ownership percentage $relown_{ij}^{ETF}(t)$ of stock i by fund j, summed across all ETFs $j \epsilon N$ who own stock i in month t.

$$|r_{it}^{ETF}| = \sum_{j \epsilon N}\{\mathrm{T}^{-1}\sum_{\tau=1}^{\mathrm{T}}|r_{j\tau}^{ETF}| * relown_{ij}^{ETF}(t)\} \tag{5}$$

In (5), $|r_{j\tau}^{ETF}| = |prc_{j\tau}^{ETF} - NAV_{j\tau}^{ETF}|/prc_{j\tau}^{ETF}$ denotes the absolute daily deviation in ETF share price from NAV as a percent of ETF share price of fund j, and T , the number of days in the month.

Analogous to Amihud (2002), we proxy $PMLIQ_{it}$, the secondary market liquidity on stocks underlying ETFs provided by the primary market activities of APs as:

$$PMLIQ_{it} = |r_{it}^{ETF}|/dvol_{it}^{ETF} \tag{6}$$

In (6), $|r_{it}^{ETF}|$ denotes the volatility in ETF share prices created by order flow imbalances from liquidity

[10]See "What is the Creation/Redemption Mechanism?" at https://www.ETF.com. APs are broker dealers or financial institutions who buy and sell constituent stocks to create and redeem ETF shares. When increased demand causes ETF share prices to trade at premiums to its Net Asset Value (NAV), APs purchase a basket of stocks in exchange for new ETF shares of equal NAV. Conversely, when decreased demand causes ETF share prices to trade at discounts to its NAV, APs purchase ETF shares in exchange for a basket of stocks of equal NAV. The arbitrage profit of APs that result from the creation and redemption of ETF shares constrains the deviations of ETF share prices from NAV.

[11]We interpolate missing monthly stock holding observations by assuming ETF stock purchases and sales are distributed evenly across missing months based on average holdings for current and prior months. A missing observation is recorded when an ETF fails to report holdings for 6 consecutive months.

[12]The monthly volume of shares purchased across ETFs is $\sum_j(n_{ij}(\tau) - n_{ij}(\tau-1)|n_{ij}(\tau) - n_{ij}(\tau-1) \geq 0)$ and monthly volume of shares sold across ETFs is $\sum_j(n_{ij}(\tau) - n_{ij}(\tau-1)) - \sum_j(n_{ij}(\tau) - n_{ij}(\tau-1)|n_{ij}(\tau) - n_{ij}(\tau-1) \geq 0)$.

(noise) trading in ETF shares by uninformed investors, and $dvol_{it}^{ETF} = p_{it} * vol_i^{ETF}(t)$, expressed in millions of dollars, the aggregate value of stock shares underlying ETFs used to create or redeem ETF shares. $PMLIQ_{it}$ characterizes the purchases or sales of underlying stock shares, $dvol_{it}^{ETF}$, that APs need to manage the volatility in ETF share price $|r_{jt}^{ETF}|$. Large values of $PMLIQ_{it}$ indicate the secondary market liquidity on stocks underlying ETFs provided by the primary activities of APs is high – the dollar volume of purchases or sales of stock shares underlying ETF shares necessary to manage volatility in ETF share prices from liquidity (noise) trading in ETF shares by uninformed investors is small in size.[13]

To make changes in $PMLIQ$ comparable across stocks and months in our regression analyses, we assign stocks each month into 100 portfolios with percentile ranks that range from a low of 0.01 to a high of 1.00 in increments of 0.01. Low, median, and high $PMLIQ$ quintile portfolios represent stocks with percentile ranks 0.01 to 0.20, 0.41 to 0.60, and 0.81 to 1.00, respectively. A natural log transform reported in summary statistics corrects for the considerable left skew in the sample distribution of $PMLIQ$. For brevity, we refer to a 0.40 change in percentile rank, which is approximately one standard deviation in $ln(PMLIQ)$, simply as a one standard deviation increase in $PMLIQ$.

< Insert Figure II here. >

Over the sample period 2004:06 to 2019:12, the rise in median ETF ownership and fall in median liquidity provided by the primary market activities of APs indicates a bifurcation in the concentration of ETF ownership from a sharp rise in the number of ETFs. Figure II Panel A shows a concave cross-sectional relationship between $PMLIQ$ and ETF ownership. In Figure II Panel B, $PMLIQ$ increases with expanding ETF ownership when the concentration of ETF ownership is below median but decreases when the concentration of ETF ownership is above median. In each month, we also sort stocks into a high and low N ETF portfolios by the number of ETFs who own the same stock. If the number is above median, High N ETF dummy equals 1, and 0, otherwise. If the number is below the median, Low N ETF dummy equals 1, and 0, otherwise. The $PMLIQ$-ETF ownership relation in the low N ETF portfolio is similar to the high HHI portfolio, and in the high N ETF portfolio is similar to the low HHI portfolio.

< Insert Figure III here. >

Similarly, we sort stocks into percentiles by ETF ownership concentration each month and

[13]In contrast, Amihud (2002) illiquidity is high when small changes in traded dollar volume are sufficient to cause (rather than moderate) high stock price volatility.

compute the average $ln(PMLIQ)$ in each percentile. Figure III graphs $ln(PMLIQ)$ averaged across months for each percentile. For stocks with below median ETF ownership concentration, AP primary market activities are fairly uniform, but increase dramatically when ETF ownership concentration is high. To maintain orderly markets, it appears a greater volatility in ETF share prices from liquidity (noise) trading in ETFs with concentrated stock holdings elicits relatively more intervention by APs.

G. Secondary Market Impact Variables

Stock Return Volatility and Illiquidity

For each stock, return volatility is measured as the standard deviation of daily stock returns $r_{i,t}$ in a month. We use an Amihud (2002) illiquidity measure, $illiq_{i,d}$, to characterize and control for the secondary market liquidity of underlying stocks.

$$illiq_{i,d} = |r_{i,d}|/dvol_{i,d} \tag{7}$$

In (7), $illiq_{i,d}$ is the daily ratio of absolute stock return $|r_{i,d}|$ to dollar trading volume $dvol_{i,d}$ on day d of stock i expressed in millions of dollars. The positive relationship between transaction volume and price change is a proxy for the price impact of order flow. Higher values of $illiq_{i,d}$ indicate lower liquidity.

To avoid potential contamination from outliers, we eliminate the top and bottom 1% of daily $illiq_{i,d}$, and for each stock, we compute monthly liquidity, $illiq_{i,t}$, as daily illiquidity averaged over days in the month. To make changes in Amihud illiquidity comparable across stocks and months in our regression analyses, we also assign stocks each month into 100 portfolios with percentile ranks ranging from 0.01 to 1.00 in increments of 0.01. A natural log transform reported in summary statistics corrects for the considerable left skew in the sample distribution of Amihud illiquidity. We refer to a 0.40 change in percentile rank, which is approximately one standard deviation in $ln(illiq_{i,t})$, simply as a one standard deviation increase in illiquidity.

Bid-Ask Spread

As a proxy for trading cost, we use Corwin and Schultz (2012) to compute a stock's daily spread $S_{i,d}$ as:

$$S_{i,d} = \frac{2(e^{\alpha}-1)}{1+e^{\alpha}} \quad \alpha = \frac{\sqrt{2\beta}-\sqrt{\beta}}{3-2\sqrt{2}} - \sqrt{\frac{\gamma}{3-2\sqrt{2}}} \quad \gamma = [\, Ln\,(\frac{H^{O}_{d,d+1}}{L^{O}_{d,d+1}})\,]^2 \quad \beta = \sum_{j=0}^{1} [\, Ln\,(\frac{H^{O}_{d+j}}{L^{O}_{d+j}})\,]^2 \tag{8}$$

setting negative daily spreads to zero. Observed daily high–low price ratios have a stochastic time-varying component which reflects the variance in intraday stock return and a time-invariant fixed bid-ask spread. The Corwin-Shultz measure captures the time-invariant "true" bid-ask spread. Monthly

spread is estimated as daily spread averaged over days in the month, and we require at least 12 daily observations in a month to calculate monthly spread.

Noise Trading

To proxy for noise trading, we use an AR1 process on daily stock returns to estimate the autocorrelation $\rho_{i,t}$ for each stock i over days in month t. We compute the k-settlement period variance ratio, $vratio_{i,t}$, as the variance of k-period returns divided by k times the variance of single-period returns, to assess the transitory component of stock prices over a fixed window of interest.

$$vratio_{i,t} = \frac{var(ret_{i,t,:t+k})}{k* var(ret_{i,t,:t+1})} = \frac{k*var(ret_{i,t,:t+1})+k(k-1)\rho_{i,t}var(ret_{i,t,:t+1})}{k* var(ret_{i,t,:t+1})}$$
$$= 1 + (k-1)\rho_{i,t} \quad (9)$$

where $ret_{i,t,:t+k}$ is the k-settlement period return, $ret_{i,t,:t+1}$ is the single-period return, and $\rho_{i,t}$ is the one-period autocorrelation in single-period return. A variance ratio less than 1 substantiates return reversals associated with the price pressure effects of order imbalances from noise trading when liquidity is poor. A variance ratio greater than 1 substantiates return drift (momentum) when value-relevant information from informed trading is not impounded into stock prices in a timely manner.

As in Ben-David et al. (2018), we set $k = 5$ to represent weekly stock returns.[14] APs place orders to create or redeem shares with ETF fund sponsors during or at end of day. The settlement date is typically trade date plus three days ($T + 3$). If an AP fails to deliver the securities to the fund sponsor on $T + 3$, the AP must post collateral until delivery occurs. However, as market makers, APs have up to six days after trade date ($T + 6$) to settle with counterparties. APs may delay settlement because it could be cheaper to cover a short ETF position or sell a long ETF position through stock trades in the secondary securities market rather than creation or redemption of ETF shares with fund sponsors. Rule 204 of SEC regulation SHO issued in July 2009 on short-sales states "… subject to certain conditions, fails to deliver resulting from long sales or certain bona fide market making activity must be closed out by no later than the beginning of regular trading hours on the third settlement day after settlement date ($T + 6$)."[15]

Market Return Beta

[14]Results are essentially the same for 4 and 6 settlement days.

[15]The SEC report generated from the National Securities Clearing Corporation's (NSCC) Continuous Net Settlement (CNS) system does not properly capture the additional 3 days that market makers have before their trades are considered fails under Regulation SHO. A legitimate market maker trade in an ETF that settled in 4 days would show up as a "failure" under the conventional reporting scheme where all equity trades settling after 3 days are marked as fails. Supposedly higher failure-to-deliver rates in ETF shares may merely represent greater market making activity in portfolios versus comparable volume single-name equities.

Market return betas are estimated beta coefficients on market returns generated from monthly time-series regressions of daily excess returns using a Fama and French (2015) 5-factor and Carhart (1997) 4-factor model. We use market betas to estimate the covariance of stock with market returns.

III. Descriptive Statistics and Attributes of ETF Held Stocks

Table II Panel A reports summary descriptive statistics for variables used in our analysis. Variable definitions are summarized in Appendix Table I. Our final sample contains 600,070 stock-month observations from June 2004 to December 2019. During our sample period, ETF ownerships are comparable to index mutual fund ownerships and much smaller than active mutual fund ownership. ETF ownership has a mean (median) of 5.6% (4.5%), with a standard deviation of 4.9%. Mean (median) active mutual fund ownership is 15.1% (14.3%), with a standard deviation of 11.6%, and mean (median) index mutual fund ownership is 5.2% (4.7%) with a standard deviation of 3.9%.

< Insert Table II here. >

Table II Panel B reports average ETF ownership, factor informed trading in ETF shares reflected in the absolute percent deviation in ETF imputed from concurrent stock price $|r_{it}^{ETF}|$, as well as active and index mutual fund ownership on stocks sorted at the end of each month into quintiles of $PMLIQ$. $PMLIQ$ quintile portfolios are linked over the sample period. Stocks in the highest quintile of $PMLIQ$ have the lowest ETF and active (index) mutual fund ownership, and stocks in the lowest quintile of $PMLIQ$ have the higher ETF and active (index) mutual fund ownership. The average difference in ETF ownership between high and low $PMLIQ$ quintiles of -4.69% is significant at the 1% level. The average differences in active and index mutual fund ownership between high and low $PMLIQ$ quintiles of -11.25% and -2.74% respectively are both significant at the 1% level. The average difference in absolute percent deviation in ETF imputed from concurrent stock price $|r_{it}^{ETF}|$ between high and low $PMLIQ$ quintiles of 0.54% is significant at the 1% level.

Table II Panel C reports the percentage of stocks sorted into quintile portfolios by $PMLIQ$ and ETF ownership respectively that are constituent stocks in the DJ30 and S&P500. The median ETF ownership quintile portfolios have the most holdings of S&P 500 as well as Dow 30 stocks, 32.8% are S&P 500 stocks and 1.57% are Dow 30 stocks. $PMLIQ$ is more significant, however, in ETFs that do not have constituent stocks in the S&P500 and DJ30. In the bottom quintile portfolio of stocks sorted by $PMLIQ$, 67.40% of the stocks are in the S&P500 and 2.55% are in the DJ30.

< Insert Table III. >

Table III reports the characteristics of ETF held stocks sorted each month into quintile portfolios

by $PMLIQ$ and ETF ownership, as well as into ETF ownership concentration (HHI) portfolios by above and below median ETF ownership. Summary portfolio statistics on variables used in our analysis are computed at the end of each month and linked over the sample period to form a time-series. For brevity, we only report the top and bottom quintile portfolios of stocks sorted by $PMLIQ$ and ETF ownership.

Liquidity (noise) trading by uninformed investors in ETFs is more likely to trigger $PMLIQ$ when the underlying stocks are associated with informationally opaque firms, and ETF ownership of underlying stocks is low and highly concentrated. Stocks in the top $PMLIQ$ quintile portfolio are relatively small market capitalization stocks, with low growth and low profitability, low price, and low CRSP turnover. Compared to stocks in the lowest $PMLIQ$ quintile portfolio, stocks in the top $PMLIQ$ quintile portfolio also exhibit significantly lower liquidity, higher average volatility, and higher Corwin-Schultz bid-ask spread.

Factor informed trading on ETF shares reflected in the percent deviation of ETF imputed from concurrent stock price $|r_{it}^{ETF}|$ is greater on stocks when $PMLIQ$ is also high. Difference of 0.54% in $|r_{it}^{ETF}|$ between the top and bottom $PMLIQ$ quintiles is significant at the 1% level. $|r_{it}^{ETF}|$ is also greater on stocks where ETF ownership is high but HHI is low.

IV. Does Primary Market Activity Signal Private Information?

In this section, we examine the impact of $PMLIQ$ and ETF ownership on future excess returns. Dependent variables and regressors are winsorized[16] and normalized by their standard deviations over the sample period, except for abnormal returns and cumulative abnormal returns. Definitions of control variables can be found in Appendix Table I Variable Definitions. We show $PMLIQ$ creates space for trading in ETF held stocks on idiosyncratic firm-specific information which enhance price discovery. Excess returns, which reflect the economic gains on costly private information, will be greater on stocks where $PMLIQ$ is high.

A. Persistence of Primary Market Activity

To assess persistence, we sort stocks by $PMLIQ$ into quintiles each month. The percentage of stocks that either remain or change to another quintile in the subsequent month are computed each month. We construct a transition matrix for $PMLIQ$ by averaging the percentage changes across months in the sample period. The average percentage of stocks that remain in the same quintile are

[16]Winsorized by the top and bottom 1% when values can be positive or negative, and winsorized by top 1% when values can only be positive.

along the diagonal, and the percentage of stocks that change quintiles are in the off diagonals.

< Insert Table IV here. >

The transition matrix for $PMLIQ$ and a similarly constructed transition matrix for ETF ownership are reported in Table IV. The dominant diagonal shows that $PMLIQ$ exhibits a significant predictable component. The likelihood that stocks with top quintile of $PMLIQ$ in the prior month will remain in the top quintile of $PMLIQ$ in the current month is 78.18%. Similarly, the likelihood that stocks in top ETF ownership quintile in the prior month will remain in the top quintile of ETF ownership in the current month is 94.69%. Changes in ETF ownership decay more slowly.

B. Future Excess Returns

We use three excess return proxies. From time-series regressions of daily stock returns, we estimate an average daily alpha using a Carhart (1997) 4-factor model as well as Fama and French (2015) 5-factor model. Average daily alphas are compounded to obtain average monthly alphas. Daniel, Grinblatt, Titman and Wermers (1997) returns are estimated as monthly stock returns minus returns on a benchmark portfolio of stocks sorted by size and book-to-market to which the stock belongs. We link the estimated average monthly buy-and-hold excess returns to form a time-series of monthly excess returns.

Given the persistence of $PMLIQ$, we examine excess returns in lead one to four months following the formation of quintile portfolios of stocks sorted by $PMLIQ$ each month. To compute quintile portfolio excess returns, we compute the value-weighted portfolio monthly 4-factor and 5-factor alphas and DGTW excess return across stocks in the portfolio. We link the monthly quintile portfolio returns across months in the sample period to form a time-series of excess returns.

< Insert Table V here. >

Results corroborate our conjecture that excess returns will be greater on ETF held stocks where uninformed trading on ETF shares stimulate high levels of $PMLIQ$. As evident in Table V Panel A, high-low quintile portfolios sorted on $PMLIQ$ yield significant average lead one month 4-factor and 5-factor alphas of 0.442% and 0.635%, and DGTW excess return of 0.422%. Moreover, 42.5% of the high-low 5-factor alpha and 87.7% of the DGTW excess return in lead one month come mainly from the long side – that is, the difference between high and middle quintile portfolios. Further, average 5-factor alphas and DGTW excess return on high-low quintile portfolios decline but continue to be statistically significant in lead two to four months following portfolio formation. Lead four-month 4-factor alpha, 5-factor alpha, and DGTW excess return are 56.9% (=0.799/1.403), 60.1%

(=0.865/1.439), and 57.1% (=0.819/1.434) of their lead one-month returns. Average excess returns are higher on ETF held stocks where the acquisition of idiosyncratic firm-specific information spurred by the liquidity provided by the primary market activities of APs is more significant. Average excess returns are higher on ETF held stocks where the acquisition of firm-specific information spurred by the liquidity provided by the primary market activities of APs is more significant.

Table V Panel B reports two-way sorts of stocks. First, into above and below median ETF ownership concentration portfolios, and second, into quintile portfolios by $PMLIQ$. $PMLIQ$ increases the incentive to acquire and trade on idiosyncratic firm-specific information when ETF ownership concentration (HHI) is low. When HHI is low, average lead one-month excess return spread on high-low quintile portfolios sorted on $PMLIQ$ are higher; on 4- and 5-factor alphas by 0.63% (=0.916-0.284) and 0.934% (=1.201-0.267), and on DGTW excess return by 0.612% (=0.607-0.005). Moreover, average high-low excess return spreads decline but continue to be economically significant through lead four months. For stocks with below median HHI, average lead four-month 4- and 5-factor alphas and DGTW excess return are 26.4% (=0.167/0.632), 42.0% (=0.392/0.934) and 52.5% (=0.321/0.612) of lead one-month returns.

We corroborate these findings in stock-month fixed effects regressions of excess returns on $PMLIQ$ reported in Table VI. Except for $PMLIQ$ and Amihud illiquidity which are expressed in percentiles, all other regressors are normalized by their sample standard deviations. Errors are clustered by stock and month. Coefficients on size, book-to-market, momentum, CRSP turnover, inverse price, and profitability are reported in Appendix Table III.

< Insert Table VI here. >

In the top panel of Table VI, a one standard deviation rise in $PMLIQ$ increases average lead one-month 4-factor alpha by 0.572% (=1.430*0.40), 5-factor alpha by 0.576%, and DGTW excess return by 0.574%, all of which are significant at the 1% level. Further, consistent with the persistence of $PMLIQ$, average excess returns decline but continue to be significant through lead four months. Average lead four-month 4-factor alpha, 5-factor alpha, and DGTW excess return are 56.9% (=0.799/1.403), 60.1%, and 57.1% of their corresponding average one-month average alphas and DGTW excess return.

The bottom panel shows that regardless of ETF ownership concentration (HHI), a one standard deviation rise in $PMLIQ$ increases average excess returns. On average lead one-month 4-factor alpha, 5-factor alpha, and DGTW excess return, by 0.192% (=(0.648-0.168)*0.4), 0.188%, and 0.159%

respectively when HHI is high. When HHI is low, by 8.68% (=0.217*0.4), 0.696%, and 0.932% respectively.

The incentive to acquire and trade on idiosyncratic firm-specific information is more pronounced when HHI is high. The increase in average excess returns from a one standard deviation rise in $PMLIQ$ are greater when HHI is high. Average lead one-month 4-factor alpha, 5-factor alpha, and DGTW excess return are greater by 0.172% (=(0.648-0.217)*0.4), 0.196%, and 0.134% respectively.

Overall, results support our conjecture that liquidity (noise) trading in ETF shares stimulate $PMLIQ$ which spurs active investors to acquire and trade on costly firm-specific information. Higher average future excess returns substantiate the private information of active investors in stocks underlying ETFs.

B. Earnings Announcements

We examine secondary market trading in ETF held stocks around earnings announcements. We use cumulative abnormal returns (CAR) to proxy for the information content of earnings surprises. CARs are computed from daily returns in excess of returns on a benchmark portfolio to which the stock belongs over a 5-day window around earnings announcement date denoted as $CAR(-2,+2)$ as well as from the third day after earnings announcement date to the earlier of 60 days or day prior to subsequent earnings announcement date, denoted as $CAR(3,60)$.

Benchmark portfolios are constructed following the method described in French's website. At June end of each year t, stocks are sorted into 2×3 benchmark portfolios by size (ME) and book-to-market equity (BE/ME). Median ME on NYSE stocks and the 30th and 70th percentiles of BE/ME on NYSE stocks, computed as book equity in the fiscal year end in $t-1$ divided by ME in December of $t-1$, are used as breakpoints. Regression results using CAR as dependent variable is reported in Table VII. All regressions control for stock and month fixed effects and cluster by stocks and months.

< Insert Table VII here. >

In Table VII, significant coefficients on $PMLIQ$ confirm that more private information is made public at earnings announcements on ETF held stocks where $PMLIQ$ prior to earnings announcements is high. Privately informed investors in ETF held stocks anticipate earnings surprises in the subsequent quarter. From Columns 1 and 2, a 10-percentile rise in $PMLIQ$ predicts a higher average lead $CAR(-2,+2)$ of 5.83 bps and higher average lead one quarter $CAR(3,60)$ of 0.218%, both economically and statistically significant. ETF ownerships, however, decrease the private information incentives by locking up shares. A one-standard-deviation increase in ETF ownership decreases lead

$CAR(-2,+2)$ by 0.096%, lead one and two quarter $CAR(3,60)$ by 0.698% and 0.417%, with the latter two significant at least at 5% level.

Results in Columns 4 and 5 corroborates our prior finding that $PMLIQ$ motivates more trading on idiosyncratic firm-specific information when ETF ownership concentration is high. For stocks with high $PMLIQ$, around the five-day earnings announcement window, high HHI predicts a significantly higher average lead $CAR(-2,+2)$ of 0.275% (=0.356-0.081) over stocks with low HHI. For stocks with low $PMLIQ$, the spread between high HHI and low HHI stocks is 0.217%. Similarly, over the longer post earnings announcement window, for stocks with high $PMLIQ$, higher HHI predicts a significantly higher $CAR(3,60)$ of 0.640% (= 0.757-0.117) over stocks with lower HHI, and for stocks with low $PMLIQ$, the spread is 0.252%.

Moreover, controlling for HHI of ETF ownerships, higher $PMLIQ$ still significantly strengthens the private information incentive of traders. High outperform low $PMLIQ$ stocks on average lead $CAR(-2,+2)$ by 0.139% (=0.356–0.217) when HHI is high, by 0.081% when HHI is low. Similarly, high outperform low $PMLIQ$ stocks on average lead one and two quarter $CAR(3,60)$ by 0.505% (=0.757-0.252) and 0.434% (=0.518–0.084) when HHI is high. However, only the high and low $PMLIQ$ spreads when HHI is high are significant. The acquisition of costly idiosyncratic firm-specific information in ETF held stocks spurred by $PMLIQ$ is intrinsically fundamental and long-term in nature.

< Insert Figure IV here. >

Figure IV shows that private idiosyncratic firm-specific information made public at earnings announcements is more significant on stocks where $PMLIQ$ is high. On high $PMLIQ$ quintile portfolios, significant lead average $CAR(-2,+2)$ of 0.35% around earnings announcement dates is greater than lead average $CAR(-2,+2)$ of 0.04% on low $PMLIQ$ quintile portfolios by 0.31%. Moreover, $CARs$ on high $PMLIQ$ quintile portfolios stay above that on low $PMLIQ$ quintile portfolios over the entire 60-day horizon. Earnings surprises reflect positive fundamental news on high $PMLIQ$ quintile stocks.

The observed overshoot and reversal exhibited in lead average $CAR(3,60)$ over the post-earnings announcement period points to secondary market overreactions to earnings surprises in stocks where $PMLIQ$ is high. In ETF held stocks where $PMLIQ$ is high, the overshoot in the first quarter from initial lead average $CAR(-2,+2)$ of 0.35% is eliminated in the three months following earnings announcement. In ETF held stocks where $PMLIQ$ is low, lead average $CAR(-2,+2)$ of 0.04% is an

underreaction of uninformed investors to earnings surprises at earnings announcement date. The underreaction stays through the first month, continues to drift down in the third month, and is practically reversed in sign after sixty days to a negative lead average of -0.19% over the earnings announcement period.

< Insert Table VIII here. >

Table VIII reports $CARs$ across 4 fiscal quarters. Prior literature documents earnings forecast errors are highest in the fourth quarter (Collins, Hopwood and McKeown, 1984). Write-offs are more likely to happen at the end of fiscal year. Managers also tend to delay bad news to the end of fiscal year and adjust earnings in subsequent fiscal years to safeguard earnings bonuses in the current fiscal year. The value of private idiosyncratic firm-specific information will be more critical in the fiscal years prior to the end of the fiscal year where adjustments are more likely.

Consistent with prior literature, we find the effect of $PMLIQ$ is more pronounced at the end of fiscal year compared to the 1st and 2nd fiscal quarters. In the 3rd quarter, $PMLIQ$ forecasts higher $CAR(-2,+2)$, and $CAR(3,60)$ of 33% (= 0.008/0.006-1) and 62.5% (=0.026/0.016–1). In contrast, the negative lockup effects of ETF ownership are consistently significant for $CAR(3,60)$, and $CAR(-2,+2)$ in the 4th fiscal quarter where earnings forecast errors are highest.

Overall, our findings support the thesis that $PMLIQ$ creates space for informed trading in ETF held stocks which enhances price discovery. In ETF held stocks where $PMLIQ$ is high, prices signal the future return expectations of privately informed investors.

V. Robustness Tests

A. Stock Return Volatility

Two-way stock and month fixed effects regressions on stock return volatility are reported in Table IX, respectively. On half of the model specifications, we control for one-month lag in dependent variables and on the other half, we control for three months of lags. Errors are clustered by stock and month. Coefficients on size, book-to-market, momentum, CRSP turnover, inverse price, and profitability are reported in Appendix Table III.

< Insert Table IX here. >

Return Volatility

The effects of $PMLIQ$ and ETF ownership on stock return volatilities support the liquidity channel and liquidity buffer hypotheses. As conjectured, the decrease in the monthly volatility of daily stock returns from $PMLIQ$ corroborates the increase in secondary market liquidity from the primary market

activities of APs, and the increase in monthly volatility from higher ETF ownership corroborates the adverse effect of higher liquidity buffers on secondary market liquidity. In Column 1 of Table IX, a one standard deviation rise in $PMLIQ$ decreases average stock return volatility by 17.25% (=0.069*0.40*0.015/0.024), where 0.024 and 0.015 are the mean and standard deviation of stock return volatility reported in Table II. A one standard deviation rise in ETF ownership increases average stock return volatility by 1.13% (=0.045*0.40*0.015/0.024). Results are statistically significant at the 1% level and robust to control for three months of lags in return volatility reported in Column 2. Column 3 and 4 suggests higher intervention of APs in stocks with high ETF ownership concentration are necessary to achieve the same reduction in stock return volatility. Coefficients on the interaction of $PMLIQ$ and HHI are not significant.

Our liquidity buffer impact of ETF ownership is considerably smaller than those reported in Ben-David et al. (2018) which confounds $PMLIQ$ with ETF ownership. We compare our results in Column 2 to theirs in Table VIII Panel A which control for three months of lags in return volatility. In our Column 2, a one standard deviation rise in ETF ownership increases average return volatility by 2.00% (=0.032*0.015/0.024). In Column 8 of Ben-David et al. (2018) Table IV Panel A, a one standard deviation rise in ETF ownership increases average return volatility on S&P500 stocks by 5.36% (=0.077*0.0140/0.0201) and by 3.57% (=0.053*0.0176/0.0261) on Russell 3000 stocks. The lockup effects of ETF ownership are robust to model specifications in Column 3 and 4, and the magnitudes are also similar.

B. Bid-Ask Spread and Noise Trading

Two-way stock and month fixed effects regressions on spread and variance ratios are reported in Table X Panels A, B and C. On half of the model specifications, we control for one-month lag in dependent variables and on the other half, we control for three months of lags. Errors are clustered by stock and month. Coefficients on size, book-to-market, momentum, CRSP turnover, inverse price, and profitability are reported in Appendix Table III.

<Insert Table X here.>

Corwin-Schultz Spread

If the migration from stocks to ETFs are largely dominated by individual investors, the diffusion of uninformed trading in ETF shares onto underlying stocks through $PMLIQ$ increases secondary market liquidity. For market makers, the likelihood of trading against informed investors is diminished. Taken together with a lower search costs of matching buyers and sellers and lower return

volatility, a lower adverse selection cost will prompt market markers to reduce spread on ETF held stocks in secondary markets.

In contrast, the reduction in effective float from higher ETF ownership decreases secondary market liquidity. Taken together with higher search costs of matching buyers and sellers and higher return volatility, a higher adverse selection cost will prompt market markers to raise spread on ETF held stocks in secondary markets. Higher transaction cost and price impact of trading will restrain trading in ETF held stocks on secondary markets.

In Columns 5 and 6, the impact of $PMLIQ$ on Corwin-Schultz spreads are unchanged controlling for factor informed trading in ETF shares. Further, as Cong et al. (2016) show, market makers will protect themselves against informed trading on systematic market factors in ETFs and underlying stocks by increasing spreads. A one standard deviation rise in factor informed trading increases average spread by 0.67% (=0.011*54.051/88.205) where 88.205 and 54.051 are the standard deviation and mean of Corwin-Schultz spreads reported in Table II. Results are significant at the 1% level and robust to control for three months of lags in spread, and as shown in Appendix Table IV, is unchanged when we use residual $|r_{it}^{ETF}|$, which is orthogonal to $PMLIQ$, to proxy for factor informed trading instead.

Noise Trading

The impact of $PMLIQ$ on Corwin-Schultz average daily spread in a month supports the liquidity channel hypothesis. As conjectured, in Column 1 of Table X Panel A, a one standard deviation rise in $PMLIQ$ decreases average spread by 2.80% (=0.114*0.40*53.855/87.722). The decrease in average spread is statistically significant at the 1% level and robust to control for three months of lags reported in Column 2. ETF ownership increases spreads, though insignificantly.

Further, as Cong et al. (2016) show, we find informed trading in ETFs on systematic market factors increases Corwin-Schultz spreads in underlying stocks, as the possibility to trade against factor informed traders is increased. Market makers will protect themselves against informed trading on systematic market factors in ETFs and underlying stocks by increasing spreads. A one standard deviation rise in informed factors trading increases average spreads by 0.24% (=0.004*53.855/87.722) controlling for a one-month lag in spreads in Column 1, and by 0.31% (=0.005*53.855/87.722) controlling for three months of lags in spreads in Column 2, significant at the 5% and 1% levels.

The impact of $PMLIQ$ on spread are more significant when $PMLIQ$ and ETF ownership concentration (HHI) are both high. In Column 4, for stocks with above median $PMLIQ$, above median HHI stock portfolios have 0.18% (=(0.012-0.009)*53.855/87.722) lower average spreads compared

to below median HHI stock portfolios.

Noise Trading

Variance ratios less (greater) than 1 indicate negative (positive) autocorrelation in returns. Returns exhibit mean reversion when market liquidity is poor and order imbalances from uninformed (noise) trading create buying or selling price pressure. Returns exhibit drift when liquidity enables informed trading, but there are delays in incorporating value-relevant information into prices.

In Table X Panel B Columns 1 and 5, the concurrence of positive and insignificant coefficients on $PMLIQ$ indicate a decrease in negative (variance ratios below 1) and increase in positive (variance ratios above 1) autocorrelations in returns. As conjectured, $PMLIQ$ increases secondary market liquidity. A one standard deviation rise in $PMLIQ$ decreases (increases) negative (positive) variance ratios on average by 0.89% (=0.065*0.40*0.915/0.664) where 0.915 and 0.664 are the standard deviation and mean of the variance ratio reported in Table II. In Column 2, results are similar and significant at the 1% level controlling for three months of lags in variance ratio.

Lower return reversals and higher return drifts substantiate the diffusion of uninformed demand shocks in ETF shares onto underlying stocks through $PMLIQ$ enhances secondary market liquidity that accommodates noise and informed trading in stocks underlying ETFs. Moreover, taken together with Columns 3 and 4 in Panel B, the increase in liquidity from $PMLIQ$ are greater on stocks when ETF ownership concentration is high, that is, when stocks are narrowly owned by a few ETFs. For stocks with above median $PMLIQ$, the increase in variance ratio is greater on average when ETF ownership concentration is above median by 3.17% (=(0.052-0.029)*0.915/0.664). Moreover, for stocks with below median $PMLIQ$, the increase in variance ratio is greater on average when ETF ownership concentration is above median by 5.65% (=0.041*0.915/0.664). The increase in variance ratio is greatest when stocks have above median $PMLIQ$ and ETF ownership concentration.

High levels of factor informed trading on ETF shares attenuate positive autocorrelation but increase mean reversion in stock returns. This finding suggests it is difficult for market makers and other market participants to correctly distinguish noise trading from factor informed trading in ETF held stocks. The significantly negative coefficients in Columns 1 through 4 in conjunction with insignificant results in Column 5 through 8 show factor informed trading on variance ratio decreases drifts and increases reversals. In Column 1, a one-standard-deviation increase in factor informed trading decreases (increases) positive (negative) autocorrelations in returns on average by 1.93% (=0.014*0.915/0.664). As shown in Appendix Table IV, the effects of informed trading on systematic

market factors on variance ratios are robust when we use residual $|r_{it}^{ETF}|$, which is orthogonal to $PMLIQ$, to proxy for factor informed trading instead.

C. Market Return Beta

The decrease in bid-ask spread and increase in noise trading from higher $PMLIQ$ predicts lower market return betas. Similarly, the decrease in market betas from $PMLIQ$ is greater when ETF ownership concentration is higher.

Two-way stock and month fixed effects regressions on market return betas estimated from Carhart (1997) 4-factor and Fama-French (2015) 5-factor model are reported in Table X. Errors are clustered by stock and month. Coefficients on size, book-to-market, momentum, CRSP turnover, inverse price, and profitability are reported in Appendix Table III.

< Insert Table XI here. >

As conjectured, $PMLIQ$ decrease the market return betas of ETF held stocks, significant at the 1% level. In Column 1 of Table XI, a one standard deviation rise in $PMLIQ$ decreases Carhart (1997) 4-factor average market return beta by 10.35% (=0.205*0.40*1.119/0.886) where 1.119 and 0.886 are the standard deviation and mean of 4-factor market return betas reported in Table II. In Column 2, results are also significant at the 1% level and robust to control for three months of lags in market return beta. Similarly, a one standard deviation rise in $PMLIQ$ decreases Fama-French 5 factor average market return beta by 10.96% (= 0.215*0.40*1.136/0.891).

In contrast, ETF ownership increases the market return betas of ETF held stocks, significant at the 1% level. As conjectured, in Column 1, a one standard deviation rise in ETF ownership increases Carhart (1997) 4-factor average market return beta by 6.06% (=0.048*1.119/0.886) Similarly, in Column 5, one standard deviation rise in ETF ownership increases Fama-French 5 factor market return beta by 5.73% (=0.045*1.136/0.891). Results are significant at the 1% level and robust to control for three months of lags in Columns 2 and 6.

Moreover, as Cong et al. (2016) show, informed trading on systematic market factors will increase co-movement and synchronicity in underlying stock returns. In Columns 1 and 2, 5 and 6, a one standard deviation rise in factor informed trading will increase average market return beta on a 4-factor model by 3.53% (=0.028*1.119/0.886) and 3.46% (=0.026*1.119/0.886), and 5-factor model by 3.44% (=0.027*1.136/0.891) and 3.19% (=0.025*1.136/0.891), controlling for one-month and three months of lags in market return beta. Results are significant at the 1% level, and as shown in Appendix Table IV, are robust when we use residual $|r_{it}^{ETF}|$, which is orthogonal to $PMLIQ$, to proxy

for factor informed trading instead.

Columns 3 and 4 show the decrease in market return beta from $PMLIQ$ is more pronounced on stocks with above median ETF ownership concentration. Results are statistically significant at the 1% level and robust to control for three months of lags. On stocks with below median ETF ownership concentration, the impact of above and below median $PMLIQ$ are not significantly different.

Overall, our findings support the liquidity buffer and liquidity channel hypotheses. The share lockup from ETF ownership creates a liquidity buffer which decreases secondary market liquidity and increases stock return volatility. At the same time, the migration of investors from stocks to ETFs makes the role of APs as market makers important. Excess volatility in ETF share prices from liquidity (noise) trading of uninformed investors on ETF shares trigger the primary market activities of APs. The purchases or sales of underlying stock shares in exchange for ETF shares enhance the secondary market liquidity of underlying stocks.

V. Conclusion

Since its introduction in 1993, the popularity and growing market share of ETFs raise concerns among academics, practitioners, and policymakers about potential market distortions. Current empirical studies show increased ETF ownership reduces secondary market liquidity and increases stock return volatility. ETF ownership creates a liquidity buffer which impairs price informativeness.

Herein, we argue that as market makers, the role of APs is to maintain an orderly market in ETF shares. The creation or redemption of ETF shares in the primary market are intended to curb excessive volatility in ETF share prices from the liquidity (noise) trading of uninformed investors. The liquidity provided by APs through primary market activities is high when the volume of purchases or sales of underlying stock shares necessary to curb volatility in ETF share price is small.

We document two important empirical findings. First, we show liquidity (noise) trading in ETF shares which stimulate primary market activities by APs spurs active investors to acquire and trade on costly idiosyncratic firm-specific information. Primary market activities by APs are more pronounced when ETFs ownership on underlying stocks is low and concentrated among a few ETFs, and underlying stocks are associated with more informationally opaque firms. High levels of liquidity provided by the primary market activities of APs predict higher future excess stock returns. Further, we find cumulative abnormal returns ($CARs$) in the 5-day window around earnings announcement date and in the 60-day post-earnings announcement period are greater on stocks where the liquidity provided by the primary market activities by APs is high.

Second, we show composite securities (ETFs) make space for active asset managers to become informed about systematic market factors and exploit their informational advantage by trading in them (ETFs). Informed trading on systematic market factors in ETF shares attenuates post-earnings announcement drifts in cumulative abnormal returns.

In sum, our study finds that in their role as market makers, the liquidity provided by the primary market activities of APs in response to the liquidity (noise) trading in ETF shares enhance price informativeness.

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Table I
ETF Stocks and Fund Ownership

Over the sample period June 2004 to December 2019, columns 2 to 4 report summary statistics on the average total number of CRSP stocks, as well as the average number and percentage of CRSP stocks in our sample that meet a minimum share price of $5 and market capitalization of $10 million. In columns 5 to 9, the average number and percentage of stocks in our sample owned by ETFs and the stock ownerships of ETFs as well as active and index mutual funds. In columns 10 to 13, the average number and percentage of stocks in our sample not owned by ETFs and the stock ownerships of active and index mutual funds.

				Average No. of Stocks Held by ETFs					Average No. of Stocks Not Held by ETFs			
						Average Ownership					Average Ownership	
Sample Period	All CRSP Stocks	Stock Sample	% of CRSP Stocks	No. of Stocks	% of Stock Sample	ETF	Active Mutual Fund	Index Mutual Fund	No. of Stocks	% of Stock Sample	Active Mutual Fund	Index Mutual Fund
2004:06-2004Q4	5,261	4247	80.73%	3,658	86.13%	2.11%	15.37%	3.69%	706	16.62%	3.25%	1.09%
2005Q1-2005Q4	5,327	4420	82.97%	3,860	87.33%	2.08%	15.52%	3.07%	1178	26.65%	2.94%	0.83%
2006Q1-2006Q4	5,239	4459	85.11%	3,882	87.06%	2.59%	16.26%	4.13%	797	17.87%	2.33%	0.74%
2007Q1-2007Q4	5,200	4421	85.02%	3,811	86.20%	3.07%	16.15%	4.25%	803	18.16%	2.18%	0.77%
2008Q1-2008Q4	4,866	3882	79.78%	3,424	88.20%	3.84%	17.20%	3.91%	599	15.43%	1.76%	0.64%
2009Q1-2009Q4	4,589	3264	71.13%	3,019	92.49%	5.00%	18.74%	4.94%	356	10.91%	1.94%	0.79%
2010Q1-2010Q4	4,393	3427	78.01%	3,261	95.16%	5.20%	17.17%	5.17%	273	7.97%	2.25%	0.96%
2011Q1-2011Q4	4,204	3382	80.45%	3,244	95.92%	5.28%	16.67%	4.80%	243	7.19%	2.20%	0.41%
2012Q1-2012Q4	4,059	3227	79.50%	3,115	96.53%	5.98%	16.27%	5.27%	200	6.20%	1.40%	0.33%
2013Q1-2013Q4	4,025	3357	83.40%	3,279	97.68%	6.39%	16.02%	5.81%	240	7.15%	1.71%	0.30%
2014Q1-2014Q4	4,084	3518	86.14%	3,423	97.30%	6.80%	15.71%	6.33%	238	6.77%	1.93%	0.29%
2015Q1-2015Q4	4,100	3467	84.56%	3,399	98.04%	7.58%	16.09%	6.46%	177	5.11%	1.39%	0.13%
2016Q1-2016Q4	4,027	3352	83.24%	3,278	97.79%	8.51%	15.86%	7.06%	145	4.33%	1.22%	0.19%
2017Q1-2017Q4	3,959	3354	84.72%	3,259	97.17%	9.79%	15.34%	7.26%	248	7.39%	2.45%	0.69%
2018Q1-2018Q4	3,930	3343	85.06%	3,234	96.74%	10.75%	15.72%	8.97%	312	9.33%	6.28%	2.51%
2019Q1-2019Q4	3,927	3274	83.37%	3,175	96.98%	11.65%	12.67%	7.76%	266	8.12%	6.61%	2.29%
2004:06-2019Q4	4,449	3,650	82.07%	3,395	93.54%	6.04%	16.05%	5.56%	424	10.95%	2.62%	0.81%

Table II
Summary Statistics

Panel A reports summary statistics on variables used in this study. Number of observations is 514,142. Panel B reports average ETF stock ownership, average active and indexed mutual fund stock ownership sorted into quintiles by the liquidity provided by primary market activities of APs $(PMLIQ)$ each month. Panel C reports average percentage of Dow Jones 30 and S&P 500 stocks in portfolios sorted by $PMLIQ$, ETF ownership and HHI of ETF ownership. $PMLIQ$ on stock i in month t is computed as $ln(|r_{it}^{ETF}|/dvol_{it}^{ETF})$ where $|r_{it}^{ETF}|$ is a relative ETF ownership weighted sum of daily absolute percentage deviations of ETF share price from net asset value averaged across days in the month, and $dvol_{it}^{ETF}$ is the dollar volume purchase or sale of stock shares by ETFs who own the stock summed across all ETFs in the month expressed in millions of dollars. Relative ETF ownership is the total number of shares owned by ETFs at month end as a percentage of total shares outstanding. Mutual fund ownership of stock i in month t is estimated similarly. Daily Amihud illiquidity $illiq_{i,d} = |r_{i,d}|/dvol_{i,d}$ is absolute daily return divided by daily trading volume in millions of dollars, and monthly Amihud illiquidity is daily Amihud illiquidity averaged across days in the month. Volatility is computed as the standard deviation of daily stock returns over the month. Spread is average daily spread $S_{i,t} = \Sigma_d S_{i,d}/d$ expressed in bps, calculated following Corwin and Schultz (2012) with adjustments setting negative daily spread to zero and averaged each month. $S_{i,d} = 2(e^{\alpha}-1)/(1+e^{\alpha})$, $\alpha = [\sqrt{2\beta} - \sqrt{\beta}]/[3-2\sqrt{2}] - [\gamma/(3-2\sqrt{2})]^{0.5}$, $\gamma = [\, Ln\,(H_{d,d+1}^{O}/L_{d,d+1}^{O})\,]^2$, and $\beta = \sum_{j=0}^{1} [\, Ln\,(H_{d+j}^{O}/L_{d+j}^{O})\,]^2$. The variance ratio for stock i in the month is calculated as $1 + 5 * \rho_{i,t}$, where $\rho_{i,t}$ is estimated from an AR(1) process of daily returns $ret_{i,d}$ each month. 4-factor market beta is the market factor coefficient estimated from monthly time-series regressions of daily excess stock returns on a four-factor Carhart (1997) model. 5-factor market beta is the coefficient on the market factor estimated from monthly time-series regressions of daily excess stock returns using the five-factor Fama and French (2015) model. Cumulative abnormal returns (CAR) around earnings announcement are computed as daily returns in excess of daily returns on a benchmark portfolio to which the stock belongs over a three-day window around earnings announcement date and from the third day to earlier of 60 days or day prior to subsequent earnings announcement date. At June end of each year t, stocks are sorted into 2×3 benchmark portfolios by size (ME) and book-to-market equity (BE/ME). Median ME on NYSE stocks and the 30th and 70th percentiles of BE/ME on NYSE stocks, computed as book equity in the last fiscal year end in $t-1$ divided by ME in December of $t-1$, are used as breakpoints. Relative market capitalization is the market value of equity computed as closing price multiplied by total shares outstanding expressed as a percentage of aggregate market value of equity at month end. Book-to-market is book equity to shareholders' equity calculated following Daniel and Titman (2006). Rolling 12-month return is the cumulative monthly return in the preceding 12-month period. CRSP turnover is French (2008) adjusted CRSP volume divided by shares outstanding. Inverse price is the reciprocal of month end closing price. Profitability is the total revenue minus cost of goods sold scaled by total assets following Novy-Marx (2013).

PANEL A: Variable Description

	Mean	Standard Deviation	Percentile		
			25th	50th	75th
$ln(PMLIQ)$	-7.997	2.813	-9.937	-8.221	-6.384
ETF Ownership	0.056	0.049	0.018	0.045	0.082
$ln(Amihud\ Illiquidity)$	-5.859	2.759	-7.943	-6.157	-4.051
$\lvert r_{it}^{ETF} \rvert$	0.260%	1.417%	0.038%	0.055%	0.099%
Active Mutual Fund Ownership	0.151	0.116	0.046	0.143	0.234
Index Mutual Fund Ownership	0.052	0.039	0.019	0.047	0.079
Stock Return Volatility	0.024	0.015	0.014	0.020	0.030
Spread (bps)	87.722	53.855	50.560	74.513	110.295
Variance Ratio	0.664	0.915	0.033	0.667	1.298
$\lvert Variance\ Ratio - 1 \rvert$	0.789	0.586	0.318	0.671	1.141
Carhart 4-Factor Market Beta	0.886	1.119	0.328	0.903	1.449
Fama-French 5-Factor Market Beta	0.891	1.136	0.331	0.904	1.455
Carhart 4-Factor Alpha	1.327%	11.761%	-4.843%	0.313%	5.995%
Fama-French 5-Factor Alpha	1.418%	12.237%	-5.020%	0.332%	6.234%
DGTW Return	0.419%	9.593%	-4.858%	-0.050%	4.988%
$CAR(-2.+2)$	0.203%	9.060%	-3.975%	0.189%	4.499%
$CAR(3.60)$	-0.118%	17.881%	-8.591%	0.067%	8.800%
$RMCAP$ (bps)	2.610	7.117	0.137	0.452	1.608
Book-to-Market Ratio	0.597	0.412	0.295	0.513	0.797
Rolling 12-month Return	0.166	0.385	-0.049	0.140	0.348
CRSP Turnover	0.130	0.139	0.037	0.090	0.169

Inverse Price	0.060	0.046	0.025	0.045	0.083	
Profitability	0.275	0.260	0.064	0.243	0.414	

PANEL B: Average ETF and Mutual Fund Ownership of Portfolios Sorted by PMLIQ

		PMLIQ						
		Low	2	3	4	High	Hi – Lo	t-stat
ETF Ownership	Mean	7.25%	8.46%	7.90%	5.64%	2.57%	-4.69%	-17.38
	Std Dev	3.47%	4.18%	4.02%	2.70%	1.24%		
	N	187	187	187	187	187		
$\lvert r_{it}^{ETF} \rvert$	Mean	0.07%	0.09%	0.12%	0.35%	0.61%	0.54%	3.78
	Std Dev	0.07%	0.09%	0.24%	1.02%	1.95%		
	N	187	187	187	187	187		
Active Mutual Fund Ownership	Mean	19.34%	21.47%	19.18%	14.53%	8.09%	-11.25%	-51.22
	Std Dev	1.87%	2.16%	2.58%	1.77%	2.35%		
	N	187	187	187	187	187		
Index Mutual Fund Ownership	Mean	6.28%	6.80%	6.73%	5.45%	3.54%	-2.74%	-13.22
	Std Dev	2.55%	2.86%	2.53%	1.77%	1.24%		
	N	187	187	187	187	187		

PANEL C: Distribution of DJ30 and S&P500 Stocks

		PMLIQ						
		Low	2	3	4	High	Hi – Lo	t-stat
DJ30	Mean	2.55%	0.01%	0.00%	0.00%	0.00%	-2.55%	-61.00
	Std Dev	0.57%	0.10%	0.01%	0.00%	0.00%		
	Median	2.56%	0.00%	0.00%	0.00%	0.00%		
S&P500	Mean	67.40%	10.44%	1.14%	0.34%	0.19%	-67.22%	-109.16
	Std Dev	8.46%	5.58%	3.26%	1.55%	0.24%		
	Median	68.44%	10.01%	0.35%	0.17%	0.17%		
		ETF Ownership						
		Low	2	3	4	High	Hi – Lo	t-stat
DJ30	Mean	0.02%	0.61%	1.57%	0.25%	0.02%	1.54%	31.83
	Std Dev	0.07%	0.58%	0.66%	0.46%	0.06%		
	Median	0.00%	0.36%	1.63%	0.00%	0.00%		
S&P500	Mean	0.98%	9.80%	32.82%	25.37%	7.76%	31.84%	79.97
	Std Dev	0.45%	9.40%	5.46%	4.90%	4.31%		
	Median	0.89%	4.79%	34.69%	25.65%	6.71%		

Table III
Characteristics of ETF Held Stocks

Table III reports summary statistics on the characteristics of ETF-owned stocks sorted each month into quintile portfolios by the liquidity provided by the primary market activities of APs ($PMLIQ$) and ETF ownership, as well as into above and below median portfolios by ETF ownership concentration (HHI). From June 2004 to December 2019, stocks are sorted each month into quintiles by $PMLIQ$ (left panel) or ETF ownership (right panel), and quintiles are linked over the sample period. Stocks are also sorted into one above median and one below median group each month by their HHI of ETF ownership (middle panel). Other variable definitions can be found in Table II and Appendix Table I.

		PMLIQ			**ETF Ownership Concentration**			**ETF Ownership**		
		Quintile		Hi – Lo	Median		Hi – Lo	Quintile		Hi – Lo
		Low	High	(t-stat)	Below	Above	(t-stat)	Low	High	(t-stat)
ETF Ownership Concentration	Mean	0.138	0.442	0.304	0.120	0.321	0.201	0.550	0.120	-0.427
	Std Dev	0.032	0.085	(46.03)	0.017	0.062	(42.52)	0.080	0.020	(-70.73)
	Median	0.131	0.419		0.115	0.302		0.540	0.120	
$ln(Amihud\ Illia)$ (bps)	Mean	0.138	0.368	0.230	0.0032	0.2673	0.264	0.631	0.004	-0.627
	Std Dev	0.032	0.154	(19.91)	0.0021	0.0803	(44.95)	0.217	0.004	(-39.59)
	Median	0.131	0.323		0.0027	0.2644		0.653	0.003	
$\left\|r_{it}^{ETF}\right\|$	Mean	0.07%	0.61%	0.54%	0.37%	0.11%	-0.27%	0.09%	0.49%	0.40%
	Std Dev	0.07%	1.95%	(3.78)	1.13%	0.13%	(-3.24)	0.11%	1.52%	(3.56)
	Median	0.04%	0.07%		0.05%	0.06%		0.07%	0.06%	
Stock Return Volatility	Mean	0.019	0.027	0.009	0.022	0.026	0.004	0.030	0.020	-0.005
	Std Dev	0.007	0.008	(11.21)	0.008	0.007	(5.69)	0.010	0.010	(-6.51)
	Median	0.016	0.025		0.020	0.024		0.030	0.020	
Corwin-Schultz Spread (bps)	Mean	64.189	104.61	40.422	78.067	98.622	20.555	102.67	82.56	-20.112
	Std Dev	25.060	27.292	(14.92)	26.724	26.155	(7.52)	22.41	28.52	(-7.58)
	Median	56.177	98.417		70.321	90.585		98.61	72.63	
Variance Ratio	Mean	0.760	0.548	-0.211	0.735	0.665	-0.071	0.530	0.730	0.197
	Std Dev	0.261	0.159	(-9.47)	0.246	0.179	(-3.18)	0.140	0.260	(9.09)
	Median	0.762	0.557		0.743	0.674		0.530	0.720	
Carhart 4-Factor Market Beta	Mean	1.008	0.684	-0.324	1.045	0.856	-0.189	0.560	1.070	0.506
	Std Dev	0.063	0.152	(-26.89)	0.046	0.097	(-24.02)	0.130	0.070	(45.84)
	Median	1.005	0.688		1.043	0.859		0.570	1.060	
Fama-French 5-Factor Market	Mean	1.020	0.687	-0.334	1.051	0.858	-0.193	0.580	1.070	0.491
	Std Dev	0.068	0.152	(-27.45)	0.049	0.093	(-25.18)	0.130	0.070	(46.52)
	Median	1.022	0.687		1.049	0.864		0.580	1.060	
$Relative\ MCAP\ (bps)$	Mean	11.338	0.228	-11.110	3.651	2.091	-1.560	0.820	1.140	0.324
	Std Dev	1.017	0.147	(-147.9)	0.980	0.879	(-16.19)	0.200	0.260	(13.33)
	Median	11.637	0.195		3.908	1.960		0.780	1.120	
Book-to-Market Ratio	Mean	0.482	0.750	0.268	0.547	0.623	0.076	0.750	0.600	-0.144
	Std Dev	0.083	0.156	(20.68)	0.087	0.125	(6.80)	0.160	0.090	(-10.59)
	Median	0.450	0.696		0.513	0.577		0.720	0.580	
Rolling 12-month Return	Mean	0.178	0.144	-0.034	0.147	0.184	0.038	0.190	0.130	-0.060
	Std Dev	0.149	0.168	(-2.07)	0.151	0.169	(2.28)	0.160	0.150	(-3.71)
	Median	0.193	0.150		0.155	0.196		0.210	0.140	
CRSP Turnover	Mean	0.191	0.058	-0.133	0.172	0.106	-0.066	0.060	0.170	0.111
	Std Dev	0.046	0.013	(-37.70)	0.034	0.015	(-24.50)	0.010	0.030	(44.49)
	Median	0.179	0.055		0.164	0.104		0.060	0.160	
Inverse Price	Mean	0.027	0.092	0.064	0.042	0.072	0.030	0.090	0.050	-0.040
	Std Dev	0.007	0.011	(67.04)	0.009	0.007	(35.23)	0.010	0.010	(-45.65)
	Median	0.028	0.091		0.043	0.069		0.080	0.040	
Profitability	Mean	0.292	0.250	-0.042	0.306	0.255	-0.051	0.240	0.300	0.054
	Std Dev	0.018	0.029	(-16.94)	0.017	0.022	(-25.07)	0.030	0.010	(21.32)
	Median	0.292	0.253		0.308	0.263		0.250	0.300	

Table IV
Persistence in Primary Market Activity of APs and ETF Ownership

Table reports on the persistence of the liquidity provided by primary market activities of APs ($PMLIQ$) and ETF ownership. $PMLIQ$ and ETF ownership are defined in Table II and in Appendix Table I. In Panel A, we report a transition matrix for $PMLIQ$, and in Panel B, a transition matrix for ETF ownership. We sort stocks by the liquidity provided by the primary market activities of APs and ETF ownership into quintiles in each month and compute the percentage of stocks that remain or change to another quintile in the subsequent month.

Panel A — ***PMLIQ* Transition Matrix**

		Current Month End				
		1	**2**	**3**	**4**	**5**
Prior month End	**1**	78.18%	17.98%	3.21%	0.73%	0.23%
	2	17.77%	55.93%	22.01%	3.81%	0.70%
	3	3.32%	21.77%	52.73%	20.00%	2.30%
	4	0.98%	3.98%	19.72%	58.81%	16.63%
	5	0.47%	1.08%	2.88%	17.32%	78.85%

Panel B — **ETF Ownership Transition Matrix**

		Current Month End				
		1	**2**	**3**	**4**	**5**
Prior month End	**1**	94.60%	5.13%	0.46%	0.21%	0.19%
	2	2.85%	90.86%	5.80%	0.60%	0.25%
	3	0.38%	3.97%	88.45%	6.93%	0.64%
	4	0.22%	0.68%	5.72%	88.40%	5.42%
	5	0.21%	0.27%	0.62%	4.79%	94.69%

Table V
Forecast Returns on Quintile Portfolios of Stocks Sorted by Primary Market Activity of APs

Panel A reports the average value-weighted buy-and-hold returns in the months following the formation of quintile portfolios on stocks sorted by the liquidity provided by primary market activities of APs ($PMLIQ$). In Panel B, stocks are sorted first by ETF ownership concentration and second by $PMLIQ$. In each month, dummy variable High HHI equals 1 if HHI of ETF ownership is above median, and 0 otherwise. Dummy variable Low HHI equals 1 if HHI of ETF ownership is below median, and 0 otherwise. High-Low is the difference in average monthly returns on quintile portfolios of stocks sorted by the liquidity provided by primary market activities of APs. Average monthly returns are expressed in percent. Other variable definitions can be found in Table II and Appendix Table I. Superscripts [a,b,c] denote two-tailed tests of statistical significance at the 10%, 5%, and 1% levels.

Panel A: One-Way Sort

$PMLIQ$	Carhart 4-Factor Alpha				Fama-French 5-Factor Alpha				DGTW			
	1 Mo	2 Mo	3 Mo	4 Mo	1 Mo	2 Mo	3 Mo	4 Mo	1 Mo	2 Mo	3 Mo	4 Mo
Low	0.323	0.220	0.194	0.179	0.324	0.216	0.191	0.175	0.021	-0.068	-0.094	-0.108
2	0.549	0.329	0.274	0.242	0.597	0.384	0.313	0.291	0.064	-0.102	-0.164	-0.187
3	0.642	0.430	0.336	0.297	0.694	0.471	0.393	0.350	0.067	-0.087	-0.149	-0.177
4	0.827	0.500	0.397	0.343	0.907	0.576	0.469	0.413	0.313	0.095	0.040	-0.013
High	0.764	0.397	0.257	0.172	0.959	0.595	0.461	0.389	0.442	0.226	0.136	0.071
High-Low	0.442[c]	0.177[b]	0.062	-0.007	0.635[c]	0.379[c]	0.270[c]	0.213[c]	0.422[c]	0.294[c]	0.230[c]	0.179[c]
t-stat	3.75	2.04	0.90	-0.11	5.24	4.64	3.94	3.42	3.86	3.59	3.25	2.90

Panel B: Two-Way Sort

Ownership Concentration HHI	$PMLIQ$	Carhart 4-Factor Alpha				Fama-French 5-Factor Alpha				DGTW			
		1 Mo	2 Mo	3 Mo	4 Mo	1 Mo	2 Mo	3 Mo	4 Mo	1 Mo	2 Mo	3 Mo	4 Mo
Above Median	Low	0.380	0.292	0.263	0.244	0.390	0.298	0.274	0.259	0.066	-0.020	-0.048	-0.066
	2	0.460	0.286	0.230	0.185	0.521	0.348	0.290	0.245	0.023	-0.112	-0.173	-0.201
	3	0.500	0.276	0.218	0.197	0.541	0.346	0.268	0.243	0.007	-0.162	-0.201	-0.218
	4	0.545	0.340	0.285	0.251	0.625	0.389	0.333	0.298	0.000	-0.116	-0.155	-0.203
	High	0.932	0.585	0.451	0.365	0.882	0.538	0.422	0.349	0.300	0.037	-0.054	-0.106
	High-Low	0.552[c]	0.293[c]	0.189[c]	0.120[b]	0.492[c]	0.240[c]	0.148[b]	0.090	0.234[b]	0.057	-0.010	-0.040
	t-stat	4.81	3.55	2.71	1.96	4.08	2.81	1.99	1.36	2.31	0.76	-0.09	-0.69
Below Median	Low	0.284	0.140	0.115	0.106	0.267	0.115	0.091	0.085	-0.005	-0.114	-0.146	-0.15
	2	0.728	0.497	0.395	0.326	0.861	0.600	0.477	0.415	0.245	0.082	-0.021	-0.067
	3	0.795	0.487	0.393	0.379	0.883	0.552	0.468	0.433	0.351	0.134	0.091	0.057
	4	0.802	0.365	0.248	0.164	0.959	0.542	0.438	0.393	0.460	0.196	0.158	0.109
	High	0.916	0.530	0.369	0.273	1.201	0.782	0.595	0.477	0.607	0.363	0.23	0.171
	High-Low	0.632[c]	0.390[c]	0.254[b]	0.167[a]	0.934[c]	0.667[c]	0.504[c]	0.392[c]	0.612[c]	0.476[c]	0.375[c]	0.321[c]
	t-stat	3.55	2.92	2.31	1.71	5.48	5.21	4.51	4.17	3.62	4.07	3.99	3.93

Table VI
Forecast Returns and Primary Market Activity of APs

Table reports two-way stock and month fixed effect regressions of stock excess returns on the liquidity provided by primary market activities of APs $(PMLIQ)$ and ownership. Fama French (2015) 5-factor daily alphas are estimated from time-series regressions of daily stock returns each month and compounded over days in a month. Carhart (1997) 4-factor daily alphas are estimated from time-series regressions of daily stock returns on market, SMB and HML factors and UMD factor each month and compounded over days in a month. Daniel, Grinblatt, Titman and Wermers (1997) excess returns are estimated as stock monthly return minus the average return in the month on the DGTW benchmark portfolio to which the stock belongs. Average monthly excess returns are expressed in percent. Other variable definitions can be found in Table II and Appendix Table I. Errors are clustered by stock and month. [a, b] and [c] denote 10%, 5% and 1% significant level respectively. *p*-values are in parentheses. Coefficients on other control variables are reported in Appendix Table III.

	Carhart (1997) 4-Factor Alpha				**Fama-French (2015) 5-Factor Alpha**				**DGTW (1997) Excess Return**			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
$PMLIQ$	1.403[c]	1.063[c]	0.863[c]	0.799[c]	1.439[c]	1.124[c]	0.921[c]	0.865[c]	1.434[c]	1.101[c]	1.008[c]	0.819[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$ETF\ Ownership$	-0.432[c]	-0.379[c]	-0.344[c]	-0.320[c]	-0.403[c]	-0.350[c]	-0.303[c]	-0.274[c]	-0.423[c]	-0.380[c]	-0.333[c]	-0.331[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Amihud\ illia$	3.858[c]	4.248[c]	4.429[c]	4.430[c]	3.617[c]	3.966[c]	4.194[c]	4.283[c]	3.299[c]	4.077[c]	4.273[c]	4.534[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\lvert r_{i,t}^{ETF} \rvert$	-0.128[b]	-0.102[b]	-0.093[b]	-0.100[c]	-0.125[b]	-0.096[b]	-0.087[b]	-0.092[c]	-0.114[c]	-0.081[c]	-0.074[c]	-0.065[c]
	(0.015)	(0.023)	(0.013)	(0.001)	(0.011)	(0.022)	(0.013)	(0.002)	(0.000)	(0.001)	(0.001)	(0.001)
$Active\ Mutual\ Fund\ Own$	0.004	-0.034	-0.075[b]	-0.082[b]	0.006	-0.044	-0.091[b]	-0.101[c]	0.073	0.024	-0.024	-0.032
	(0.941)	(0.416)	(0.046)	(0.019)	(0.909)	(0.308)	(0.021)	(0.006)	(0.147)	(0.581)	(0.540)	(0.376)
$Index\ Mutual\ Fund\ Own$	0.102[a]	0.064	0.053	0.060	0.094	0.047	0.023	0.029	0.147[c]	0.104[b]	0.065	0.058
	(0.079)	(0.188)	(0.226)	(0.153)	(0.116)	(0.352)	(0.609)	(0.495)	(0.004)	(0.016)	(0.117)	(0.144)
NOBS	463704	463587	463397	463063	463677	463535	463315	462950	443358	440940	438395	435692
R^2	0.029	0.051	0.071	0.091	0.029	0.051	0.071	0.091	0.031	0.060	0.086	0.112
$High\ PMLIQ \times High\_HHI$	0.648[c]	0.576[c]	0.487[c]	0.460[c]	0.663[c]	0.574[c]	0.498[c]	0.481[c]	0.567[c]	0.486[c]	0.437[c]	0.383[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Low\ PMLIQ \times High\ HHI$	0.168[b]	0.111[a]	0.126[b]	0.128[b]	0.192[b]	0.116[a]	0.114[a]	0.123[b]	0.169[b]	0.124[b]	0.127[b]	0.125[b]
	(0.019)	(0.089)	(0.041)	(0.030)	(0.012)	(0.087)	(0.073)	(0.045)	(0.012)	(0.040)	(0.024)	(0.019)
$High\ PMLIQ \times Low\ HHI$	0.217[b]	0.157[b]	0.108[a]	0.078	0.174[a]	0.139[a]	0.094	0.068	0.233[c]	0.180[c]	0.171[c]	0.113[b]
	(0.022)	(0.022)	(0.074)	(0.153)	(0.060)	(0.050)	(0.148)	(0.243)	(0.006)	(0.004)	(0.002)	(0.020)
$ETF\ Ownership$	-0.425[c]	-0.361[c]	-0.326[c]	-0.300[c]	-0.393[c]	-0.334[c]	-0.284[c]	-0.253[c]	-0.429[c]	-0.377[c]	-0.333[c]	-0.325[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
$Amihud\ illia$	4.152[c]	4.408[c]	4.558[c]	4.553[c]	3.941[c]	4.171[c]	4.353[c]	4.432[c]	3.670[c]	4.325[c]	4.504[c]	4.716[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\lvert r_{i,t}^{ETF} \rvert$	-0.052	-0.045	-0.044	-0.051[a]	-0.042	-0.032	-0.033	-0.038	-0.037	-0.023	-0.022	-0.019
	(0.273)	(0.276)	(0.206)	(0.079)	(0.348)	(0.398)	(0.312)	(0.163)	(0.192)	(0.262)	(0.240)	(0.277)
$Active\ Mutual\ Fund\ Own$	0.004	-0.033	-0.074[b]	-0.082[b]	0.005	-0.044	-0.090[b]	-0.100[c]	0.071	0.024	-0.025	-0.032
	(0.943)	(0.433)	(0.048)	(0.020)	(0.915)	(0.317)	(0.022)	(0.006)	(0.159)	(0.592)	(0.527)	(0.368)
$Index\ Mutual\ Fund\ Own$	0.115[b]	0.074	0.063	0.071[a]	0.108[a]	0.058	0.034	0.040	0.158[c]	0.113[c]	0.074[a]	0.067[a]
	(0.049)	(0.125)	(0.147)	(0.093)	(0.069)	(0.247)	(0.456)	(0.345)	(0.002)	(0.008)	(0.074)	(0.092)

NOBS	463704	463587	463397	463063	463677	463535	463315	462950	443358	440940	438395	435692
R^2	0.029	0.051	0.071	0.091	0.029	0.051	0.071	0.091	0.031	0.060	0.086	0.111

Table VII
Cumulative Abnormal Returns Around Earnings Announcements

Table examines cumulative abnormal returns (CAR) surrounding earnings announcements through two-way stock and month fixed effect regressions on the liquidity provided by primary market activities of APs $(PMLIQ)$ and ownership. Earnings announcement dates are from the IBES database. Cumulative abnormal returns are computed from daily returns in excess of daily returns on a benchmark portfolio to which the stock belongs over a five-day window around earnings announcement date $CAR(-2,2)$ as well as from the third day to the earlier of sixty days or day prior to subsequent earnings announcement date $CAR(3,60)$. Stocks at June end of each year t are sorted into 2×3 benchmark portfolios by size (ME) and book-to-market equity (BE/ME). Median ME on NYSE stocks and the 30th and 70th percentiles of BE/ME on NYSE stocks, computed as book equity in the last fiscal year end in $t-1$ divided by ME in December of $t-1$, are used as breakpoints. Benchmark portfolio returns are the value-weighted daily returns across stocks in the portfolios. Other variable definitions can be found in Table II and Appendix Table I. $CARs$ are expressed in percent. Errors are clustered by stock and month. [a, b] and [c] denote 10%, 5% and 1% significant level respectively. *p*-values are in parentheses. Coefficients on other control variables are reported in Appendix Table III.

Quarterly Earnings Announcements				
	$\boldsymbol{CAR\ (-2,+2)}$	$\boldsymbol{CAR\ (3,60)}$	$\boldsymbol{CAR\ (-2,+2)}$	$\boldsymbol{CAR\ (3,60)}$
$PMLIO$	0.583[c]	2.179[c]		
	(0.004)	(0.000)		
$ETF\ Ownership$	-0.096	-0.698[c]	-0.083	-0.705[c]
	(0.304)	(0.001)	(0.379)	(0.001)
$Hiah\ PMLIO \times Hiah\ HHI$			0.356[c]	0.757[c]
			(0.004)	(0.002)
$Low\ PMLIO \times Hiah\ HHI$			0.217[b]	0.252
			(0.020)	(0.207)
$Hiah\ PMLIO \times Low\ HHI$			0.081	0.117
			(0.340)	(0.535)
$Amihud\ illia$	6.017[c]	16.654[c]	6.109[c]	17.378[c]
	(0.000)	(0.000)	(0.000)	(0.000)
$\lvert r_{:+}^{ETF} \rvert$	-0.001	-0.136[a]	0.035	0.007
	(0.976)	(0.056)	(0.297)	(0.913)
$Active\ Mutual\ Fund\ Own$	-0.003	-0.362[c]	-0.003	-0.367[c]
	(0.961)	(0.009)	(0.958)	(0.008)
$Index\ Mutual\ Fund\ Own$	-0.083	0.302[a]	-0.072	0.324[b]
	(0.236)	(0.055)	(0.305)	(0.040)
NOBS	384331	384356	384331	384356
R^2	0.063	0.078	0.063	0.078

Table VIII
Dynamics of CAR Around Earnings Announcements

Table examines cumulative abnormal returns (CAR) surrounding earnings announcements through two-way stock and month fixed effect regressions on the liquidity provided by primary market activities of APs $(PMLIQ)$ and ownership. Earnings announcement dates are from the IBES database. Cumulative abnormal returns are computed from daily returns in excess of daily returns on a benchmark portfolio to which the stock belongs over a five-day window around earnings announcement date $CAR(-2,2)$ as well as from the third day to the earlier of sixty days or day prior to subsequent earnings announcement date $CAR(3,60)$. Stocks at June end of each year t are sorted into 2×3 benchmark portfolios by size (ME) and book-to-market equity (BE/ME). Median ME on NYSE stocks and the 30th and 70th percentiles of BE/ME on NYSE stocks, computed as book equity in the last fiscal year end in $t-1$ divided by ME in December of $t-1$, are used as breakpoints. Benchmark portfolio returns are the value-weighted daily returns across stocks in the portfolios. Other variable definitions can be found in Table II and Appendix Table I. $CARs$ are expressed in percent. Errors are clustered by stock and month. [a, b] and [c] denote 10%, 5% and 1% significant level respectively. *p*-values are in parentheses. Coefficients on other control variables are reported in Appendix Table III.

	$CAR\ (-2,+2)$	$CAR\ (3,60)$
$PMLIO \times 1st\ Qtr$	0.006[c]	0.016[c]
	(0.008)	(0.009)
$PMLIO \times 2nd\ Qtr$	0.003	0.013[b]
	(0.217)	(0.034)
$PMLIO \times 3rd\ Qtr$	0.006[b]	0.031[c]
	(0.016)	(0.000)
$PMLIO \times 4th\ Qtr$	0.008[c]	0.026[c]
	(0.001)	(0.000)
$ETF\ Ownership \times 1st\ Qtr$	-0.000	-0.009[c]
	(0.730)	(0.000)
$ETF\ Ownership \times 2nd\ Qtr$	-0.001	-0.006[b]
	(0.262)	(0.016)
$ETF\ Ownership \times 3rd\ Qtr$	-0.000	-0.007[c]
	(0.926)	(0.002)
$ETF\ Ownership \times 4th\ Qtr$	-0.003[b]	-0.008[c]
	(0.011)	(0.000)
$Amihud\ illia$	0.060[c]	0.165[c]
	(0.000)	(0.000)
$\lvert r_{it}^{ETF} \rvert$	0.000	-0.001[a]
	(0.951)	(0.071)
$Active\ Mutual\ Fund\ Own$	-0.000	-0.004[c]
	(0.883)	(0.006)
$Index\ Mutual\ Fund\ Own$	-0.001	0.003[a]
	(0.241)	(0.055)
$ln(RMCAP)$	-0.004[c]	-0.014[c]
	(0.000)	(0.000)
Book/Market Ratio	-0.002[b]	-0.004[b]
	(0.020)	(0.020)
Rolling 12-month return	0.000	-0.000
	(0.734)	(0.795)
CRSP Turnover	0.001[a]	0.006[c]
	(0.055)	(0.002)
Inverse Price	0.007[c]	0.020[c]
	(0.000)	(0.000)
Profitability	0.001	0.005[a]
	(0.321)	(0.056)
NOBS	384341	384366
R^2	0.063	0.078

Table IX
Stock Return Volatility

Table reports two-way stock and month fixed effects regressions of stock return volatility on the liquidity provided by primary market activities of APs ($PMLIQ$) and ETF ownership. Volatility is the standard deviation of daily stock returns over the month. For stock i each month, dummy variable High HHI equals 1 if HHI of ETF ownership is above median, and 0 otherwise. Dummy variable Low HHI equals 1 if HHI of ETF stock ownership is below median, and 0 otherwise. Other variable definitions can be found in Table II and Appendix Table I. Errors are clustered by stock and month. [a, b] and [c] denote 10%, 5% and 1% significant level, respectively. *p*-values are in parentheses. Coefficients on other control variables are reported in Appendix Table III.

	Stock Return Volatility			
	1	**2**	**3**	**4**
$PMLIO$	-0.069[c]	-0.063[c]		
	(0.000)	(0.000)		
$ETF\ Ownership$	0.045[c]	0.032[c]	0.050[c]	0.035[c]
	(0.000)	(0.000)	(0.000)	(0.000)
$Hiah\ PMLIO \times Hiah\ HHI$			0.006	-0.002
			(0.501)	(0.821)
$Low\ PMLIO \times Hiah\ HHI$			-0.004	-0.008
			(0.517)	(0.152)
$Hiah\ PMLIO \times Low\ HHI$			-0.002	-0.002
			(0.804)	(0.780)
$ln(Amihud\ illia)$	0.458[c]	0.390[c]	0.410[c]	0.351[c]
	(0.000)	(0.000)	(0.000)	(0.000)
$\lvert r_{i,t}^{ETF} \rvert$	0.000	0.001	-0.005[b]	-0.003[a]
	(0.936)	(0.456)	(0.011)	(0.064)
$Active\ Mutual\ Fund\ Own$	0.001	0.004	0.001	0.004
	(0.874)	(0.253)	(0.774)	(0.202)
$Index\ Mutual\ Fund\ Own$	-0.014[c]	-0.006	-0.014[c]	-0.006
	(0.006)	(0.163)	(0.005)	(0.145)
1 Month Lag	0.205[c]	0.154[c]	0.206[c]	0.155[c]
	(0.000)	(0.000)	(0.000)	(0.000)
2 Month Lag		0.124[c]		0.124[c]
		(0.000)		(0.000)
3 Month Lag		0.170[c]		0.170[c]
		(0.000)		(0.000)
Stock Fixed Effects	Y	Y	Y	Y
Month Fixed Effects	Y	Y	Y	Y
Cluster by Stock and Month	Y	Y	Y	Y
NOBS	463137	456998	463137	456998
R^2	0.581	0.604	0.581	0.604

Table X
Spread and Noise Trading

Table reports two-way stock and month fixed effect regressions of spread and noise trading (variance ratio) on the liquidity provided by primary market activities of APs $(PMLIQ)$ and ETF ownership. Spread is computed following Corwin and Schultz (2012) with adjustments setting negative daily spread to zero and averaged by stock i over the number of days d in month t. We require at least 12 observations in a month. To proxy for noise trading, we use an AR1 process to estimate $\rho_{i,t}$ and compute a stock-month k-settlement period variance ratio $vratio_{i,t} = 1 + (k-1)\rho_{i,t}$. Variance ratios less than 1 indicate noise trading. For stock i in month t, HHI of ETF ownership is computed as the sum of squared ETF weights across all ETFs who own the stock, and ETF weights, as the number of shares held by the ETF as a percentage of total shares owned by all ETFs. In each month, dummy variable High HHI equals 1 if HHI of ETF ownership is above median, and 0 otherwise. Dummy variable Low HHI equals 1 if HHI of ETF ownership is below median, and 0 otherwise. Other variable definitions can be found in Table II and Appendix Table I. Errors are clustered by stock and month. [a, b] and [c] denote 10%, 5% and 1% significant level, respectively. *p*-values are in parentheses. Coefficients on other control variables are reported in Appendix Table III.

Panel A	Corwin-Schultz Spread			
	1	2	3	4
$PMLIQ$	-0.114[c]	-0.103[c]		
	(0.000)	(0.000)		
$ETF\ Ownership$	0.011	0.009	0.016[b]	0.013[b]
	(0.117)	(0.142)	(0.031)	(0.045)
$High\ PMLIQ \times High\ HHI$			-0.010	-0.012[a]
			(0.206)	(0.065)
$Low\ PMLIQ \times High\ HHI$			0.004	0.001
			(0.494)	(0.783)
$High\ PMLIQ \times Low\ HHI$			-0.009[a]	-0.009[a]
			(0.085)	(0.080)
$Amihud\ illiq$	0.791[c]	0.694[c]	0.733[c]	0.644[c]
	(0.000)	(0.000)	(0.000)	(0.000)
$\lvert r_{i,t}^{ETF} \rvert$	0.004[b]	0.005[c]	-0.002	-0.001
	(0.031)	(0.006)	(0.196)	(0.592)
$Active\ Mutual\ Fund\ Ownership$	-0.000	0.002	0.000	0.003
	(0.964)	(0.409)	(0.920)	(0.328)
$Index\ Mutual\ Fund\ Ownership$	-0.011[b]	-0.008[b]	-0.011[b]	-0.008[b]
	(0.011)	(0.049)	(0.010)	(0.043)
1 Month Lag	0.300[c]	0.231[c]	0.301[c]	0.232[c]
	(0.000)	(0.000)	(0.000)	(0.000)
2 Month Lag		0.130[c]		0.130[c]
		(0.000)		(0.000)
3 Month Lag		0.106[c]		0.106[c]
		(0.000)		(0.000)
Stock Fixed Effects	Y	Y	Y	Y
Month Fixed Effects	Y	Y	Y	Y
Cluster by Stock and Month	Y	Y	Y	Y
NOBS	458492	452512	458492	452512
R^2	0.655	0.669	0.655	0.669

	Panel B Variance Ratio				Panel C $\lvert Variance\ Ratio - 1 \rvert$			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
PMLIO	0.065[c]	0.063[c]			-0.004	-0.002		
	(0.005)	(0.007)			(0.741)	(0.840)		
ETF Ownership	0.006	0.006	0.008	0.008	-0.004	-0.005	-0.005	-0.006
	(0.407)	(0.412)	(0.290)	(0.289)	(0.283)	(0.249)	(0.175)	(0.159)
$Hiah\ PMLIO \times Hiah\ HHI$			0.052[c]	0.051[c]			-0.015[c]	-0.014[c]
			(0.000)	(0.000)			(0.004)	(0.010)
$Low\ PMLIO \times Hiah\ HHI$			0.042[c]	0.041[c]			-0.015[c]	-0.014[c]
			(0.000)	(0.000)			(0.000)	(0.001)
$Hiah\ PMLIO \times Low\ HHI$			0.029[c]	0.027[c]			-0.009[b]	-0.009[b]
			(0.000)	(0.000)			(0.024)	(0.035)
Amihud illia	-0.243[c]	-0.235[c]	-0.246[c]	-0.238[c]	0.105[c]	0.103[c]	0.115[c]	0.113[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\lvert r_{i,t}^{ETF} \rvert$	-0.014[c]	-0.014[c]	-0.012[c]	-0.012[c]	0.002	0.001	0.002	0.002
	(0.001)	(0.001)	(0.004)	(0.006)	(0.333)	(0.479)	(0.223)	(0.338)
Active Mutual Fund Ownership	0.018[c]	0.018[c]	0.018[c]	0.018[c]	-0.006[c]	-0.006[c]	-0.006[c]	-0.006[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.007)	(0.008)	(0.006)	(0.007)
Index Mutual Fund Ownership	-0.015[c]	-0.015[c]	-0.014[b]	-0.014[c]	-0.001	-0.001	-0.001	-0.001
	(0.006)	(0.005)	(0.011)	(0.009)	(0.741)	(0.838)	(0.645)	(0.744)
1 Month Lag	0.017[c]	0.016[c]	0.016[c]	0.016[c]	-0.003	-0.003	-0.003	-0.003
	(0.000)	(0.000)	(0.000)	(0.000)	(0.199)	(0.182)	(0.186)	(0.171)
2 Month Lag		0.010[c]		0.009[c]		-0.003		-0.003
		(0.000)		(0.000)		(0.248)		(0.240)
3 Month Lag		0.010[c]		0.010[c]		-0.002		-0.002
		(0.000)		(0.000)		(0.252)		(0.242)
Stock Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Month Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Cluster by Stock and Month	Y	Y	Y	Y	Y	Y	Y	Y
NOBS	458504	452561	458504	452561	458504	452561	458504	452561
R^2	0.111	0.111	0.111	0.111	0.064	0.065	0.064	0.065

Table XI
Market Return Beta

Table reports two-way stock and month fixed effect regressions of market return betas on the liquidity provided by primary market activities of APs ($PMLIQ$) and ETF ownership. Market return betas are estimated beta coefficients on market returns generated from monthly time-series regressions of daily excess returns using a Carhart 4-factor model (Column 1-4) or Fama-French 5-factor model (Column 5-8). For stock i in month t, HHI of ETF ownership is computed as the sum of squared ETF weights across all ETFs who own the stock, and ETF weights, as the number of shares held by the ETF as a percentage of total shares owned by all ETFs. In each month, dummy variable High HHI equals 1 if HHI of ETF ownership is above median, and 0 otherwise. Dummy variable Low HHI equals 1 if HHI of ETF ownership is below median, and 0 otherwise. Other variable definitions can be found in Table II and Appendix Table I. Errors are clustered by stock and month. [a, b] and [c] denote 10%, 5% and 1% significant level respectively. *p*-values are in parentheses. Coefficients on other control variables are reported in Appendix Table III.

	Carhart (1997) 4-Factor Model				**Fama-French (2015) 5-Factor Model**			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
$PMLIO$	-0.205[c]	-0.199[c]			-0.215[c]	-0.209[c]		
	(0.000)	(0.000)			(0.000)	(0.000)		
$ETF\ Ownership$	0.048[c]	0.046[c]	0.051[c]	0.049[c]	0.045[c]	0.043[c]	0.049[c]	0.047[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Hiah\ PMLIO \times Hiah\ HHI$			-0.048[c]	-0.045[c]			-0.051[c]	-0.049[c]
			(0.000)	(0.000)			(0.000)	(0.000)
$Low\ PMLIO \times Hiah\ HHI$			-0.020[c]	-0.018[b]			-0.017[b]	-0.016[b]
			(0.008)	(0.016)			(0.025)	(0.035)
$Hiah\ PMLIO \times Low\ HHI$			-0.000	-0.001			-0.003	-0.004
			(0.987)	(0.934)			(0.675)	(0.590)
$Amihud\ illia$	0.283[c]	0.274[c]	0.192[c]	0.186[c]	0.366[c]	0.358[c]	0.274[c]	0.267[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\lvert r_{i,t}^{ETF} \rvert$	0.028[c]	0.026[c]	0.014[c]	0.012[c]	0.027[c]	0.025[c]	0.012[c]	0.011[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Active\ Mutual\ Fund\ Ownership$	0.016[c]	0.015[c]	0.017[c]	0.015[c]	0.019[c]	0.018[c]	0.020[c]	0.019[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Index\ Mutual\ Fund\ Ownership$	0.009	0.008	0.007	0.007	0.005	0.004	0.003	0.003
	(0.117)	(0.139)	(0.204)	(0.235)	(0.358)	(0.405)	(0.549)	(0.606)
1 Month Lag	0.039[c]	0.037[c]	0.039[c]	0.037[c]	0.030[c]	0.029[c]	0.031[c]	0.029[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
2 Month Lag		0.035[c]		0.036[c]		0.030[c]		0.031[c]
		(0.000)		(0.000)		(0.000)		(0.000)
3 Month Lag		0.030[c]		0.031[c]		0.023[c]		0.024[c]
		(0.000)		(0.000)		(0.000)		(0.000)
Stock Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Month Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Cluster by Stock and Month	Y	Y	Y	Y	Y	Y	Y	Y
NOBS	463095	456925	463095	456925	463095	456925	463095	456925
R^2	0.096	0.098	0.096	0.099	0.096	0.099	0.097	0.099

Figure I
Primary Market Activity of APs and ETF Ownership Effects

In Figure I, the upper forward loop shows the migration of noise traders to ETFs from individual stocks and concomitant reduction in the supply of stocks available for trading, creates a buffer which diminishes secondary market liquidity on ETF-owned stocks. Absolute deviations of ETF share prices from net asset values (NAV) signal uninformed liquidity demand in ETF shares which trigger primary market activity by authorized participants (APs). The lower feedback loop shows the exchange of ETF shares for baskets of stocks transmits liquidity shocks from ETF shares onto the underlying stocks which increases the secondary market liquidity on ETF-owned stocks.

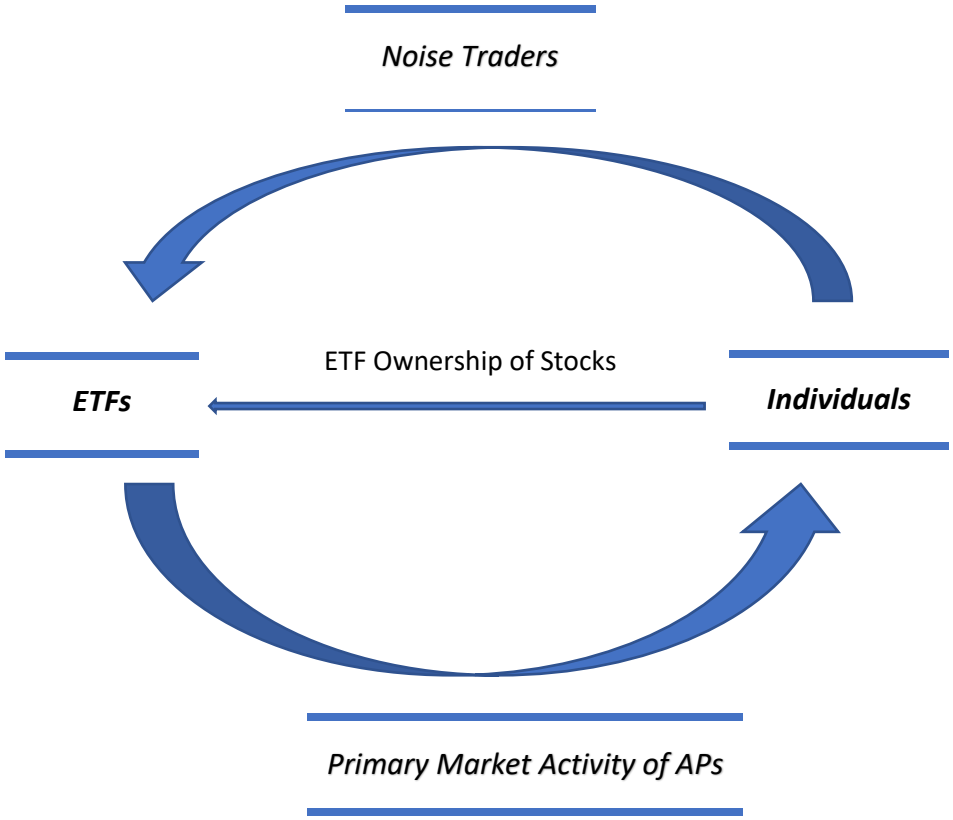
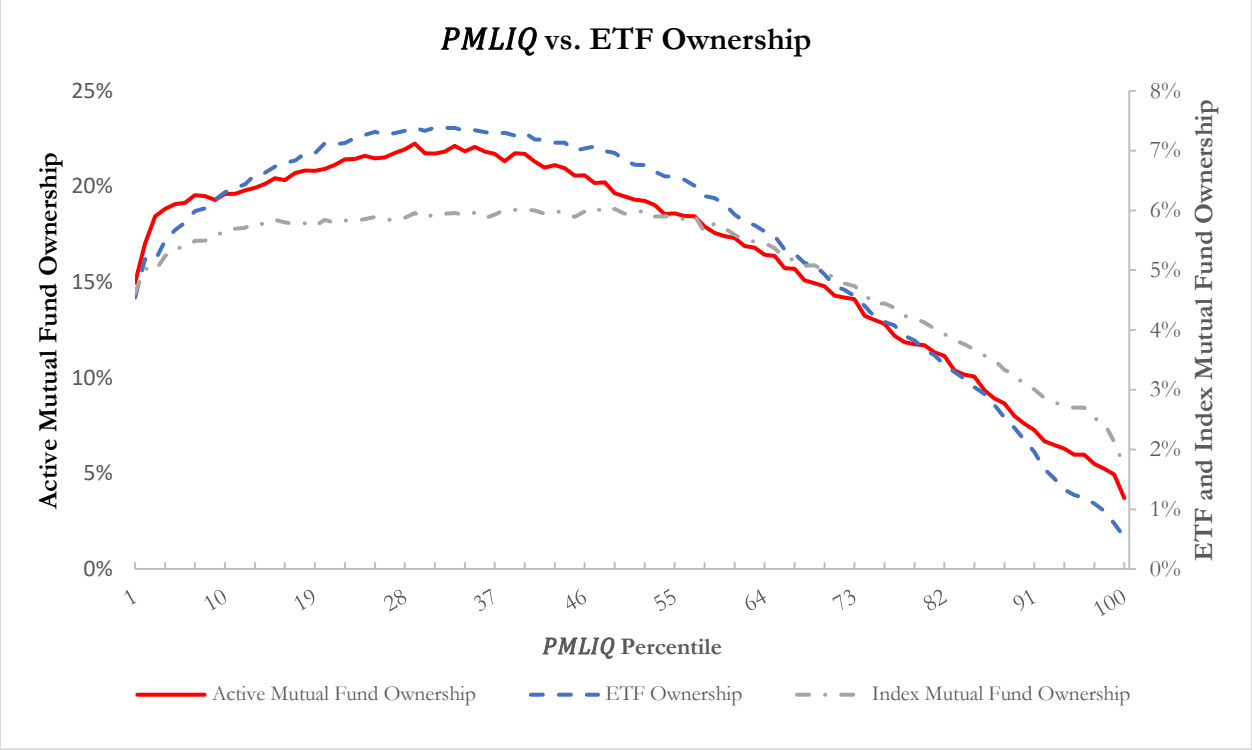


Figure II
ETF Primary Market Activities vs. Ownership (2004:06 – 2019:12)

Figure II Panel A graphs the average ETF ownership as well as active and index mutual fund ownerships, for the full sample of stocks sorted into percentile ranks each month by the liquidity provided by primary market activities of APs $(PMLIQ)$. Panel B graphs the average ETF ownership of stocks sorted into $PMLIQ$ percentile ranks each month for subsamples of stocks categorized either by ETF ownership concentration or the number of ETFs who own the stock. In each month, we separate the full sample of stocks into one subsample whose ETF stock ownership concentration (HHI) is above the median and one subsample whose HHI is equal to or below the median. Similarly, we separate the full sample into one subsample in which the number of ETFs who own the stock is above the median and one subsample in which the number of ETFs who own the stock is equal to or below the median. From June 2004 to September 2017, in each month, stocks are ranked into percentiles sorted by $ln(PMLIQ)$, then equal-weighted ETF and mutual fund ownerships are reported for each percentile. The same percentiles over the sample period are linked. $PMLIQ$ on stock i in month t is computed as $ln\left(\left|r_{it}^{ETF}\right|/dvol_{it}^{ETF}\right)$ where $\left|r_{it}^{ETF}\right|$ is a relative ETF ownership weighted sum of daily absolute percentage deviations of ETF share price from net asset value averaged across days in the month, and $dvol_{it}^{ETF}$ is the dollar volume purchase or sale of stock shares by ETFs who own the stock summed across all ETFs in the month expressed in millions of dollars. Relative ETF ownership is the total number of shares owned by ETFs at month end as a percentage of total shares outstanding. Aggregate ETF ownership is the total number of shares owned by ETFs at month end as a percentage of total shares outstanding. For stock i in month t, HHI of ETF ownership is computed as the sum of squared ETF weights across all ETFs who own the stock, and ETF weights, as the number of shares held by the ETF as a percentage of total shares owned by all ETFs. In each month, dummy variable High HHI equals 1 if HHI of ETF ownership is above median, and 0 otherwise. Dummy variable Low HHI equals 1 if HHI of ETF ownership is below median, and 0 otherwise. High N ETF and low N ETF dummy variables are defined similarly by the number of ETFs holding the stock in the month.

Panel A. Full Sample



Panel B. ETF Ownership Concentration and Number of ETFs Subsamples

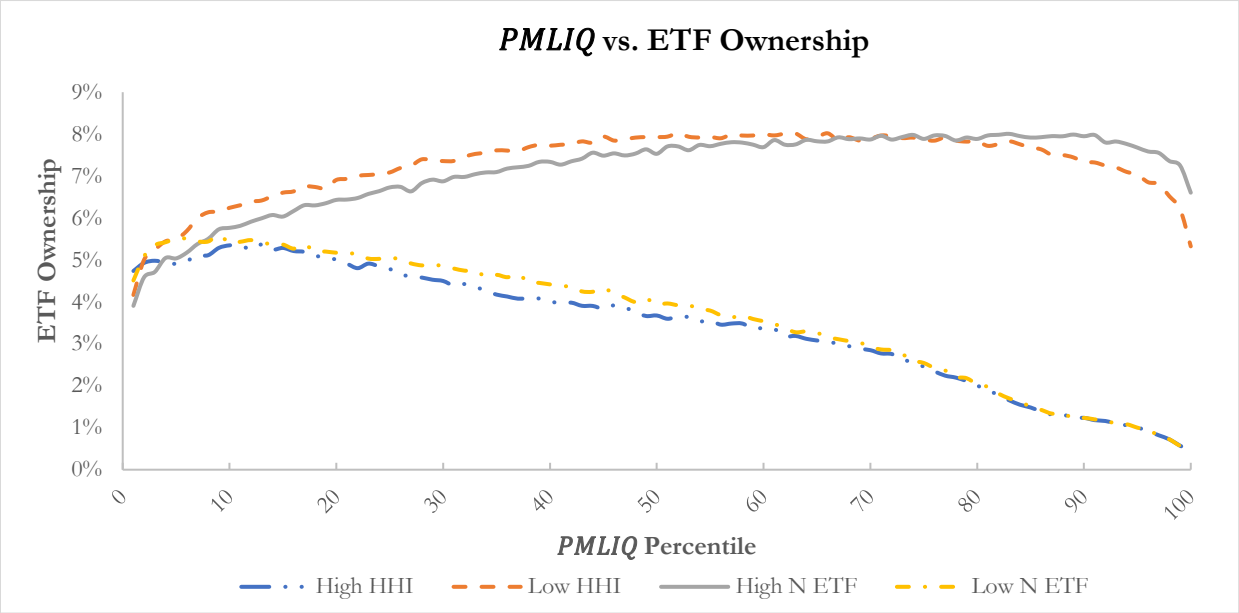


Figure III
ETF Primary Market Activities vs. ETF Ownership Concentration (2004:06 – 2019:12)

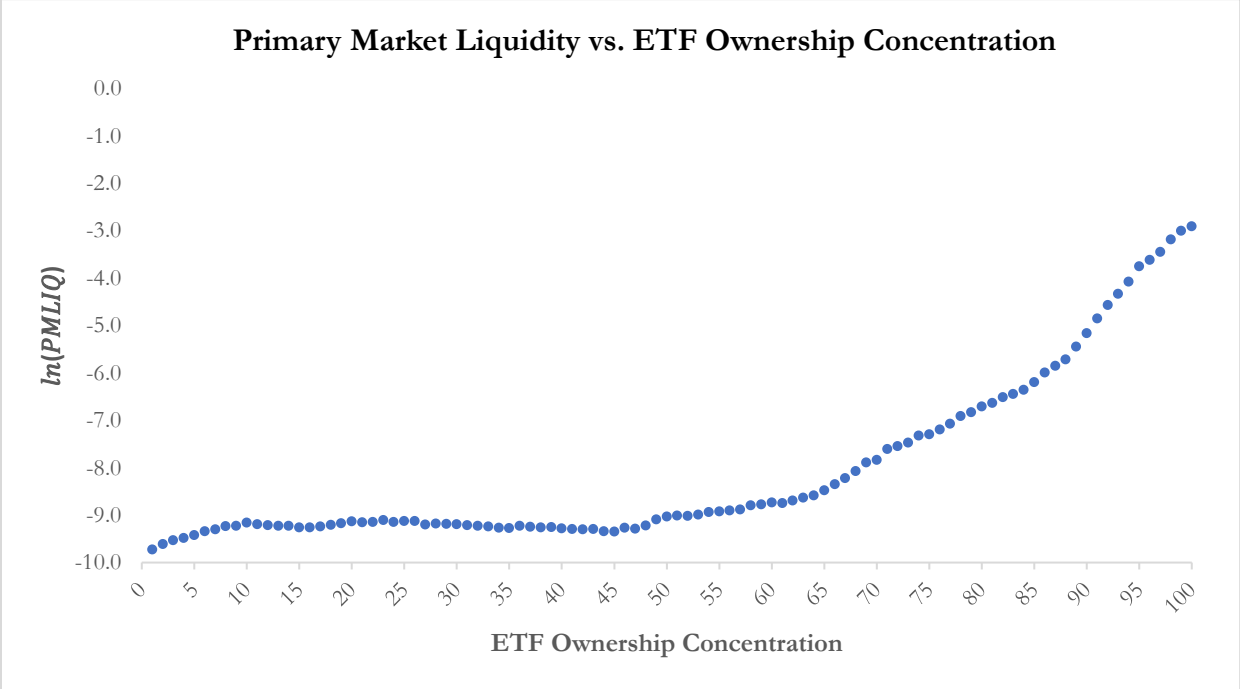
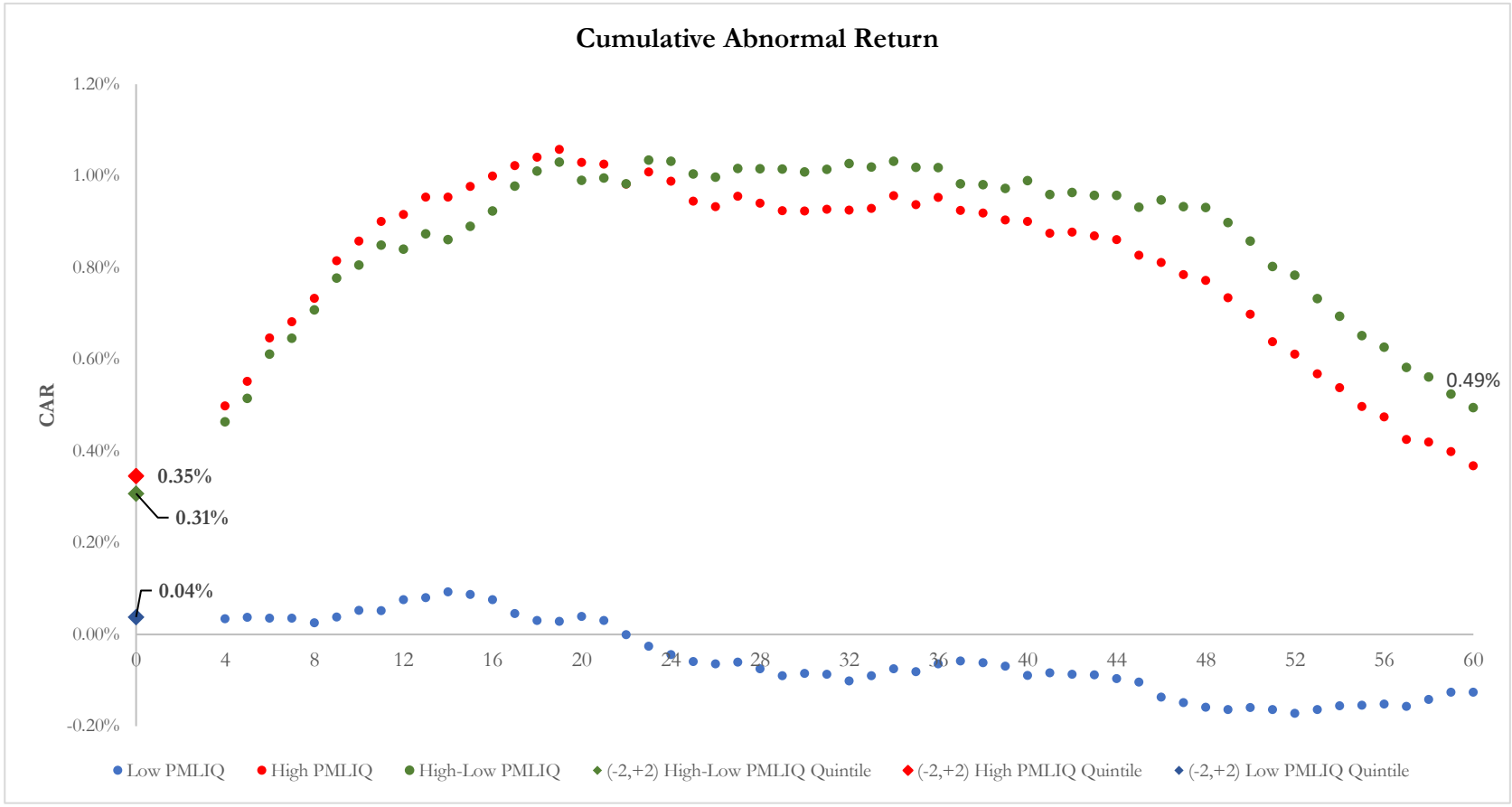


Figure IV
Cumulative Abnormal Return

Figure graphs cumulative abnormal returns (CAR) over a five-day window around earnings announcement date $CAR\ (-2, 2)$, as well as from the third day to the earlier of sixty days or day prior to subsequent earnings announcement date $CAR\ (3, 60)$. Cumulative abnormal returns are computed from daily returns in excess of daily returns on a benchmark portfolio to which the stock belongs. Stocks at June end of each year t are sorted into 2×3 benchmark portfolios by size (ME) and book-to-market equity (BE/ME). Median ME on NYSE stocks and the 30th and 70th percentiles of BE/ME on NYSE stocks, computed as book equity in the last fiscal year end in $t-1$ divided by ME in December of $t-1$, are used as breakpoints. Benchmark portfolio returns are the value-weighted daily returns across stocks in the portfolios.



Appendix Table I
Variable Definitions

ETF purchases for each stock i held by ETF j at the end of month t are computed from monthly changes in the number of shares of stock i owned by ETF j, $n_{i,j,t}$. If $n_{i,j,t} > n_{i,j,t-1}$, purchase of shares of stock i by ETF j in month t is $n_{i,j,t}$ - $n_{i,j,t-1}$, which is denoted as $purchase_{i,j,t}$. Summing across all ETFs j is the purchase of stock i by all ETFs in month t.

$$share\ purchases_{i,t} = \sum_j purchase_{i,j,t}$$

ETF sales for each stock i at the end of month t, are computed as the monthly change in number of shares stock i held by all ETFs j, $n_{i,t}$ - $n_{i,t-1}$, minus the number of shares of stock i purchased by all ETFs j in month t. This is a negative number.

$$share\ sales_{i,t} = n_{i,t} - n_{i,t-1} - share\ purchases_{i,t}$$

ETF stock ownership is the percentage of total shares outstanding of stock i owned by all ETFs j at the end of month t. The number of shares of stock i owned by ETF is summed across ETFs j at the end of month t.

$$ETF\ Ownership_{i,t} = \frac{\sum_j shares\ outstanding\ owned\ by\ ETF_{i,j,t}}{total\ shares\ outstanding_{i,t}}$$

Liquidity provided by primary market activities of APs (PMLIQ) is defined for stock i in month t, as the ratio of the $|r_{i,t}|$ to $dvol_{i,t}^{ETF}$. $|r_{i,t}|$ is the product of the monthly average of daily absolute percentage deviations of ETF share price from NAV of funds that own the stock and the number of shares of the stock owned by a fund relative to the total number of shares owned across funds averaged across all funds who own the stock. $dvol_{i,t}^{ETF}$ is the product of stock price at the end of the month $prc_{i,t}$ and number of shares purchased or sold summed over all ETFs holding the stock in the month $vol_{i,t}^{ETF}$.

$$vol_{i,t}^{ETF} = share\ purchases_{i,t} + |share\ sales_{i,t-1}|$$

$$PMLIQ_{i,t} = \frac{|r_{i,t}|}{dvol_{i,t}^{ETF}}$$

Active Mutual fund stock ownership is the percentage of total shares outstanding of stock i owned by all active mutual funds at the end of quarter. The number of shares of stock i owned by active mutual funds is summed across all active mutual fund j holding stock i at the end of quarter.

$$Active\ Mutual\ Fund\ Ownership_{i,q} = \frac{\sum_j shares\ outstanding\ owned\ by\ active\ mutual\ fund_{\ i,j,q}}{total\ shares\ outstanding_{\ i,q}}$$

Index Mutual fund stock ownership is the percentage of total shares outstanding of stock i owned by all indexed mutual funds at the end of quarter. The number of shares of stock i owned by index mutual funds is summed across all index mutual fund j holding stock i at the end of quarter.

Herfindahl-Hirschman Index (HHI) of ETF stock ownership for stock i in month t, HHI of ETF stock ownership is estimated as the sum of squared ETF weights over all ETFs holding the stock, with ETF weights estimated as the number of shares held by the ETF as a percentage of total shares held by all ETFs. We refer to it as HHI in the study for abbreviation.

Cumulative Abnormal Return (CAR) is the earnings announcement cumulative abnormal return (CAR) estimated as the five-day window around the earnings announcement date (-2, 2), as well as from the third day to the earlier of sixty days or day prior to subsequent earnings announcement date $CAR\ (3, 60)$, with returns adjusted by six size-book/market ratio portfolios formed following at the end of June each year. The size breakpoint for year t is the median NYSE market equity at the end of June of year t. BE/ME for June of year t is the book equity for the last fiscal year end in t-1 divided by ME for December of t-1. The BE/ME breakpoints are the 30th and 70th NYSE percentiles.

Amihud Illiquidity is monthly Amihud illiquidity from the prior month, with monthly Amihud illiquidity estimated as daily Amihud illiquidity averaged over the month. Daily Amihud illiquidity is the absolute daily return divided by daily trading volume in million dollars following Amihud (2002). We take natural log of Amihud illiquidity because it is highly screwed.

$$ILLIQ_{i,d} = \frac{|r_{i,d}|}{dvol_{i,d}}$$

Volatility is standard deviation of daily stock returns over the month.

Stock spread is the daily stock spread $S_{i,d}$ calculated following Corwin and Schultz (2012) with adjustments setting negative daily spread to zero and averaged across days in the month. d is the number of days in month t. Following Corwin and Schultz (2012), we require at least 12 observations in a month to calculate average monthly stock spread.

$$S_{i,d} = \frac{2(e^{\alpha}-1)}{1+e^{\alpha}} \quad \alpha = \frac{\sqrt{2\beta}-\sqrt{\beta}}{3-2\sqrt{2}} - \sqrt{\frac{\gamma}{3-2\sqrt{2}}} \quad \gamma = [\, Ln\,(\frac{H^{O}_{d,d+1}}{L^{O}_{d,d+1}})\,]^2 \;\; \beta = \sum_{j=0}^{1} [\, Ln\,(\frac{H^{O}_{d+j}}{L^{O}_{d+j}})\,]^2$$

$$S_{i,t} = \frac{\sum_d S_{i,d}}{d}$$

Variance Ratio for stock i in month t is calculated as $1 + 5 * \rho_{i,t}$, and $\rho_{i,t}$ is estimated from an AR(1) process of stock daily returns $ret_{i,d}$ each month. Absolute variance ratio is the absolute value of stock monthly variance ratio minus one.

Market beta for stock i, 4-factor market beta is the coefficient on the market factor estimated from monthly time-series regressions of daily excess stock returns on the Carhart (1997) four factor model. 5-factor market beta is the coefficient on the market factor estimated from monthly time-series regressions of daily excess stock returns on a Fama French (2015) five factor model.

Fama French 5-factor alpha is estimated from monthly time-series regressions of daily stock returns on Fama and French (2015) 5-factor model and compounded over days in a month.

Carhart 4-factor alpha is estimated from monthly time-series regressions of daily stock returns on Fama and French (1992) market, SMB and HML factors and Carhart (1997) UMD factor and compounded over days in a month.

DGTW adjusted excess return is estimated following Daniel, Grinblatt, Titman and Wermers (1997) as stock monthly return minus the average return in the month on the DGTW benchmark portfolio to which the stock belongs.

Market capitalization (in $millions) is closing price times total shares outstanding at the end of the month. Relative market capitalization is market capitalization as a percentage of aggregate market value of equity at month end.

Book to market is book equity to shareholders' equity calculated following Daniel and Titman (2006).

Rolling 12 months' return is the cumulative monthly return of the past 12 months for stock i.

CRSP Turnover is the number of shares traded in the month reported by CRSP divided by number of share outstanding at the end of the month.

Inverse price is the inverse of closing price for stock i at the end of month.

Profitability is the total revenue minus cost of goods sold scaled by total assets, following Novy-Marx (2013).

Appendix Table II
ETF Sample

This table reports the number and stock characteristics of ETFs in our sample over the 160-month period 2004:06 to 2017:09. In Panel A, by ETF fund advisors; in Panel B, by average fund size; and in Panel C by the average number of stocks held. †Missing Information.

PANEL A: TOP 10 ETF ADVISORS		Total	U.S.	Sector Equity	Int'l Equity	of Total	Total
	2004:06-2017:09						
1.	Blackrock Funds Advisors (iShares)	141	58	67	16	13.5	13.5
2.	Invesco (PowerShares)	124	52	67	5	11.8	25.3
3.	State Street Global Advisors (SPDRs)	85	32	44	9	8.1	33.4
4.	Guggenheim Investments	75	43	26	6	7.2	40.6
5.	First Trust Advisors	71	31	36	4	6.8	47.3
6.	Vanguard Group	49	32	11	6	4.7	52.0
7.	Global X Funds	40	11	26	3	3.8	55.8
8.	VanEck	31	2	29		3.0	58.8
9.	WisdomTree Investments	24	18	1	5	2.3	61.1
10.	Russell Investments	22	22			2.1	63.2
11.	All Other	386	197	146	43	36.8	100.0
	Total	*1,048*	*498*	*453*	*97*	*100.0*	
	End 2017:09						
1.	Blackrock Funds Advisors (iShares)	123	54	59	10	16.2	16.2
2.	Invesco (PowerShares)	87	41	45	1	11.4	27.6
3.	State Street Global Advisors (SPDRs)	74	30	37	7	9.7	37.3
4.	Guggenheim Investments	69	31	36	2	9.1	46.4
5.	First Trust Advisors	48	31	11	6	6.3	52.7
6.	Vanguard Group	38	21	15	2	5.0	57.7
7.	Global X Funds	24	7	15	2	3.2	60.8
8.	VanEck	22	2	20		2.9	63.7
9.	WisdomTree Investments	19	16	3		2.5	66.2
10.	Fidelity Investments	18	7	11		2.4	68.6
11.	All Other	239	146	64	29	31.4	100.0
	Total	*761*	*386*	*316*	*59*	*100.0*	
	Start 2004:06						
1.	Blackrock Funds Advisors (iShares)	56	36	19	1	70.9	70.9
2.	Vanguard Group	17	10	7		21.5	92.4
3.	Invesco (PowerShares)	3	3			3.8	96.2
4.	Guggenheim Investments	1	1			1.3	97.5
5.	First Trust Advisors	1	1			1.3	98.7
6.	Fidelity Investments	1	1			1.3	100.0
	Total	*79*	*52*	*26*	*1*	*100.0*	

PANEL B: AVE FUND SIZE		Average	U.S.	Sector Equity	Int'l Equity	PANEL C: NO. OF UNIQUE	Average	U.S.	Sector Equity	Int'l Equity
	2004:06-2017:09					2004:06-2017:09				
1.	Blackrock Funds Advisors (iShares)	3,801	4,360	5,763	1,281	Vanguard Group	4,521	6,899	4,423	2,240
2.	State Street Global Advisors	5,951	8,102	9,509	242	Blackrock Funds Advisors (iShares)	3,396	6,262	3,063	863
3.	Vanguard Group	5,421	9,610	1,556	5,097	Invesco (PowerShares)	2,874	5,245	3,317	59
4.	Invesco (PowerShares)	869	1,270	1,064	274	Guggenheim Investments	2,294	5,271	1,058	553
5.	VanEck	1,111	452	1,770		Fidelity Investments	3,350	3,864	2,835	
6.	First Trust Advisors	431	215	896	181	State Street Global Advisors (SPDRs)	2,543	4,757	2,188	684
7.	Charles Schwab	2,645	3,729	3,580	627	WisdomTree Investments	1,603	4,025	30	754
8.	Guggenheim Investments	355	915	121	28	First Trust Advisors	1,912	3,702	1,976	59
9.	Wisdom Tree	292	773	24	79	Charles Schwab	1,161	3,473	1	10
10.	DST Systems (ALPS)	1,682	293	3,071		Northern Trust (Flexshares)	1,192	3,183	112	281
11.	All Other	209	229	249	150	All Other	2,488	3,900	2,513	1,052
	Average	*2,070*	*2,722*	*2,509*	*884*	*Average*	*2,485*	*4,598*	*1,956*	*656*
	End 2017:09					End 2017:09				
1.	Blackrock Funds Advisors (iShares)	8,160	21,054	964	2,462	Vanguard Group	2,390	3,427	2,144	1,600
2.	Vanguard Group	18,368	29,831	7,434	17,840	Blackrock Funds Advisors (iShares)	1,784	3,391	1,413	548
3.	State Street Global Advisors	9,029	10,187	16,552	347	Invesco (PowerShares)	1,304	2,685	1,217	11
4.	Invesco (PowerShares)	1,481	1,961	2,174	307	State Street Global Advisors (SPDRs)	1,387	2,369	1,253	540
5.	Charles Schwab	6,710	11,877	3,708	4,546	Charles Schwab	741	2,215	1	6
6.	First Trust Advisors	747	423	1,572	247	Guggenheim Investments	908	2,185	492	47
7.	Guggenheim Investments	829	2,111	340	37	Fidelity Investments	1,589	1,046	2,131	
8.	VanEck	1,174	650	1,698		Deutsche Asset Management	970	1,937	2	
9.	Wisdom Tree	805	1,534		76	First Trust Advisors	955	1,809	1,042	15
10.	DST Systems (ALPS)	1,552	368	2,737		Fidelity Investments	1,891	1,891		
11.	All Other	302	290	418	198	All Other	1,569	2,439	1,374	895
	Average	*4,469*	*7,299*	*3,760*	*2,895*	*Average*	*1,408*	*2,309*	*1,107*	*458*
	Start 2004:06					Start 2004:06				
1.	State Street Global Advisors	2,876	7,835	724	68	Vanguard Group	2,846	3,825	1,867	
2.	Blackrock Funds Advisors (iShares)	680	1,575	324	142	Blackrock Funds Advisors (iShares)	1,519	2,959	1,561	36
3.	Vanguard Group	218	413	23		Fidelity Investments	1,491	1,491		
4.	Guggenheim Investments	372	372			State Street Global Advisors (SPDRs)	623	1,352	488	29
5.	Invesco (PowerShares)	97	97			Guggenheim Investments	483	483		
6.	Fidelity Investments	131	131			Invesco (PowerShares)	253	253		
7.	First Trust Advisors	†	†	†	†	First Trust Advisors	134	134		
	Average	*729*	*1,737*	*357*	*105*	*Average*	*1,050*	*1,500*	*1,305*	*33*

Appendix Table III
Regression Results on Control Variables

Table VI Contd.	Carhart 4-Factor Alpha				Fama-French 5-Factor Alpha				DGTW			
	1	2	3	4	5	6	7	8	9	10	11	12
$ln(RMCAP)$	-0.600[c]	-0.552[c]	-0.526[c]	-0.510[c]	-0.633[c]	-0.573[c]	-0.530[c]	-0.516[c]	-0.648[c]	-0.607[c]	-0.599[c]	-0.594[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Book/Market Ratio	-0.015	0.001	-0.013	-0.007	-0.091	-0.054	-0.049	-0.059	-0.114	-0.083	-0.078	-0.094[a]
	(0.839)	(0.981)	(0.803)	(0.890)	(0.246)	(0.388)	(0.381)	(0.260)	(0.177)	(0.157)	(0.138)	(0.056)
Rolling 12-month return	0.048	0.023	0.013	0.016	0.189[c]	0.154[c]	0.130[c]	0.123[c]	0.077	0.044	0.040	0.046
	(0.295)	(0.534)	(0.700)	(0.614)	(0.004)	(0.001)	(0.001)	(0.001)	(0.274)	(0.404)	(0.371)	(0.252)
CRSP Turnover	0.227[c]	0.201[c]	0.200[c]	0.164[c]	0.233[c]	0.184[c]	0.189[c]	0.157[c]	0.009	0.015	0.005	0.005
	(0.004)	(0.000)	(0.000)	(0.000)	(0.009)	(0.003)	(0.001)	(0.003)	(0.919)	(0.811)	(0.921)	(0.915)
Inverse Price	0.294[c]	0.296[c]	0.261[c]	0.240[c]	0.286[c]	0.280[c]	0.246[c]	0.225[c]	0.319[c]	0.323[c]	0.283[c]	0.260[c]
	(0.003)	(0.001)	(0.001)	(0.002)	(0.005)	(0.002)	(0.004)	(0.006)	(0.001)	(0.000)	(0.000)	(0.000)
Profitability	1.246[c]	1.066[c]	0.992[c]	0.962[c]	1.351[c]	1.140[c]	1.043[c]	1.007[c]	1.114[c]	0.911[c]	0.843[c]	0.809[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$ln(RMCAP)$	-0.648[c]	-0.588[c]	-0.556[c]	-0.538[c]	-0.683[c]	-0.611[c]	-0.562[c]	-0.546[c]	-0.695[c]	-0.643[c]	-0.633[c]	-0.622[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Book/Market Ratio	-0.007	0.008	-0.008	-0.002	-0.082	-0.047	-0.043	-0.053	-0.106	-0.078	-0.073	-0.090[a]

	(0.925)	(0.893)	(0.884)	(0.975)	(0.291)	(0.451)	(0.440)	(0.309)	(0.205)	(0.187)	(0.165)	(0.068)
Rolling 12-month return	0.037	0.014	0.005	0.008	0.176[c]	0.144[c]	0.121[c]	0.114[c]	0.067	0.036	0.033	0.038
	(0.421)	(0.714)	(0.893)	(0.811)	(0.008)	(0.002)	(0.002)	(0.001)	(0.343)	(0.502)	(0.470)	(0.336)
CRSP Turnover	0.220[c]	0.195[c]	0.195[c]	0.159[c]	0.226[b]	0.179[c]	0.184[c]	0.152[c]	0.003	0.010	0.001	0.001
	(0.005)	(0.001)	(0.000)	(0.000)	(0.011)	(0.004)	(0.001)	(0.004)	(0.973)	(0.873)	(0.989)	(0.978)
Inverse Price	0.295[c]	0.296[c]	0.261[c]	0.240[c]	0.286[c]	0.280[c]	0.246[c]	0.224[c]	0.320[c]	0.323[c]	0.284[c]	0.260[c]
	(0.003)	(0.001)	(0.001)	(0.002)	(0.005)	(0.002)	(0.004)	(0.006)	(0.001)	(0.000)	(0.000)	(0.000)
Profitability	1.267[c]	1.080[c]	1.004[c]	0.973[c]	1.374[c]	1.156[c]	1.056[c]	1.018[c]	1.138[c]	0.928[c]	0.859[c]	0.822[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Table VII: Contd.
Quarterly Earnings Announcements

	$CAR\ (-2,+2)$	$CAR\ (3,60)$	$CAR\ (-2,+2)$	$CAR\ (3,60)$
$ln(RMCAP)$	-0.397[c]	-1.453[c]	-0.420[c]	-1.518[c]
	(0.000)	(0.000)	(0.000)	(0.000)
Book/Market Ratio	-0.141[b]	-0.399[b]	-0.136[b]	-0.381[b]
	(0.027)	(0.014)	(0.033)	(0.018)
Rolling 12-month return	0.015	-0.026	0.007	-0.051
	(0.768)	(0.868)	(0.890)	(0.747)
CRSP Turnover	0.124[b]	0.645[c]	0.120[a]	0.637[c]
	(0.044)	(0.001)	(0.052)	(0.002)
Inverse Price	0.718[c]	2.026[c]	0.725[c]	2.062[c]
	(0.000)	(0.000)	(0.000)	(0.000)
Profitability	0.113	0.464[a]	0.112	0.464[a]
	(0.309)	(0.062)	(0.312)	(0.061)

Table IX Contd.

Stock Return Volatility

	1	**2**	**3**	**4**
$ln(RMCAP)$	-0.025[c]	-0.018[c]	-0.023[c]	-0.017[c]
	(0.001)	(0.004)	(0.003)	(0.009)
Book/Market Ratio	0.017[c]	0.005	0.017[c]	0.004
	(0.006)	(0.394)	(0.007)	(0.420)
Rolling 12-month return	0.025[c]	0.007	0.025[c]	0.007
	(0.000)	(0.181)	(0.000)	(0.151)
CRSP Turnover	0.079[c]	0.040[c]	0.078[c]	0.039[c]
	(0.000)	(0.000)	(0.000)	(0.000)
Inverse Price	0.147[c]	0.100[c]	0.145[c]	0.098[c]
	(0.000)	(0.000)	(0.000)	(0.000)
Profitability	0.002	-0.000	0.002	-0.000
	(0.784)	(0.997)	(0.814)	(0.969)

Table X Contd.

Panel A: Corwin-Schultz Spread

	5	**6**	**7**	**8**
$ln(RMCAP)$	0.017[c]	0.018[c]	0.020[c]	0.020[c]
	(0.003)	(0.001)	(0.001)	(0.000)
Book/Market Ratio	0.009[a]	0.005	0.009[a]	0.004
	(0.056)	(0.311)	(0.071)	(0.364)
Rolling 12-month return	0.026[c]	0.014[c]	0.027[c]	0.015[c]
	(0.000)	(0.000)	(0.000)	(0.000)
CRSP Turnover	0.131[c]	0.109[c]	0.131[c]	0.109[c]
	(0.000)	(0.000)	(0.000)	(0.000)
Inverse Price	0.137[c]	0.102[c]	0.134[c]	0.100[c]
	(0.000)	(0.000)	(0.000)	(0.000)
Profitability	-0.007	-0.005	-0.007	-0.005
	(0.213)	(0.277)	(0.194)	(0.254)

Table X Contd.: Panel B

Table X Contd.: Panel C

	Variance Ratio				$\lvert Variance\ Ratio - 1 \rvert$			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
$ln(RMCAP)$	-0.025[c]	-0.024[c]	-0.028[c]	-0.027[c]	0.009[b]	0.008[a]	0.009[b]	0.009[b]
	(0.005)	(0.008)	(0.001)	(0.002)	(0.045)	(0.058)	(0.032)	(0.044)
Book/Market Ratio	-0.008	-0.007	-0.007	-0.007	0.004	0.004	0.004	0.004
	(0.160)	(0.191)	(0.177)	(0.211)	(0.114)	(0.159)	(0.114)	(0.158)
Rolling 12-month return	-0.012[c]	-0.012[c]	-0.013[c]	-0.012[c]	0.000	0.000	0.000	0.000
	(0.005)	(0.006)	(0.003)	(0.004)	(0.914)	(0.841)	(0.890)	(0.825)
CRSP Turnover	-0.002	-0.002	-0.002	-0.003	-0.009[c]	-0.009[c]	-0.009[c]	-0.009[c]
	(0.728)	(0.630)	(0.604)	(0.516)	(0.000)	(0.001)	(0.001)	(0.001)
Inverse Price	-0.009	-0.009	-0.008	-0.008	0.009[c]	0.009[c]	0.009[c]	0.009[c]
	(0.114)	(0.127)	(0.154)	(0.167)	(0.006)	(0.004)	(0.005)	(0.004)
Profitability	-0.018[c]	-0.018[c]	-0.018[c]	-0.018[c]	-0.001	-0.001	-0.001	-0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.819)	(0.733)	(0.834)	(0.746)

	Table XI Contd.: Panel A				**Table XI Contd.: Panel B**			
	Carhart (1997) 4-Factor Model				**Fama-French (2015) 5-Factor Model**			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
$ln(RMCAP)$	0.017[b]	0.018[b]	0.024[c]	0.024[c]	0.001	0.002	0.008	0.008
	(0.049)	(0.032)	(0.007)	(0.004)	(0.858)	(0.823)	(0.317)	(0.305)
Book/Market Ratio	-0.019[c]	-0.019[c]	-0.020[c]	-0.020[c]	-0.005	-0.005	-0.006	-0.006
	(0.000)	(0.000)	(0.000)	(0.000)	(0.450)	(0.409)	(0.340)	(0.309)
Rolling 12-month return	0.006	0.007[a]	0.008[b]	0.009[b]	0.009	0.008	0.011[a]	0.010[a]
	(0.120)	(0.089)	(0.033)	(0.023)	(0.129)	(0.147)	(0.057)	(0.068)
CRSP Turnover	0.022[c]	0.022[c]	0.023[c]	0.022[c]	0.039[c]	0.038[c]	0.040[c]	0.038[c]

	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Inverse Price	-0.013[a]	-0.012[a]	-0.017[b]	-0.015[b]	-0.010	-0.009	-0.015[b]	-0.013[a]
	(0.055)	(0.083)	(0.014)	(0.022)	(0.146)	(0.191)	(0.046)	(0.066)
Profitability	-0.010	-0.008	-0.010	-0.009	-0.000	0.001	-0.000	0.000
	(0.163)	(0.212)	(0.151)	(0.196)	(0.992)	(0.912)	(0.946)	(0.960)

Appendix Table IV
Forecast Returns and Primary Market Activity of APs

Table reports two-way stock and month fixed effect regressions of stock excess returns on the liquidity provided by primary market activities of APs (PMLIQ) and ownership. Fama French 5-factor alpha is estimated from time-series regressions of daily stock returns on Fama and French (2015) model each month and compounded over days in a month. Carhart 4-factor alpha is estimated from time-series regressions of daily stock returns on Fama and French (1992) market, SMB and HML factors and Carhart (1997) UMD factor each month and compounded over days in a month. DGTW adjusted excess return is estimated following Daniel, Grinblatt, Titman and Wermers (1997), as stock monthly return minus the average return in the month on the DGTW benchmark portfolio to which the stock belongs. Average monthly excess returns are expressed in percent. Other variable definitions can be found in Table II and Appendix Table I. Errors are clustered by stock and month. [a, b] and [c] denote 10%, 5% and 1% significant level respectively. *p*-values are in parentheses. Coefficients on control variables are reported in Appendix Table III.

	Carhart (1997)				**Fama-French (2015)**				**DGTW**			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
$PMLIQ$	0.273[c]	0.236[c]	0.209[c]	0.192[c]	0.283[c]	0.255[c]	0.225[c]	0.211[c]	0.453[c]	0.329[c]	0.272[c]	0.231[c]
	(0.009)	(0.006)	(0.004)	(0.006)	(0.005)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
$ETF\ Ownership$	-0.458[c]	-0.391[c]	-0.353[c]	-0.326[c]	-0.425[c]	-0.358[c]	-0.306[c]	-0.275[c]	-0.423[c]	-0.380[c]	-0.336[c]	-0.330[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$ln(Amihud\ illia)$	0.851[c]	0.981[c]	1.003[c]	1.038[c]	0.856[c]	0.972[c]	1.022[c]	1.078[c]	0.466[c]	0.760[c]	0.863[c]	0.967[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.004)	(0.000)	(0.000)	(0.000)
$Residual\ \lvert r_{..}^{ETF}\rvert$	-0.097[a]	-0.087[a]	-0.086[b]	-0.093[c]	-0.092[a]	-0.079[a]	-0.079[b]	-0.084[c]	-0.118[c]	-0.083[c]	-0.071[c]	-0.066[c]
	(0.064)	(0.053)	(0.020)	(0.003)	(0.064)	(0.062)	(0.027)	(0.005)	(0.000)	(0.000)	(0.001)	(0.001)
$Active\ Mutual\ Fund\ Own$	-0.028	-0.062	-0.103[c]	-0.109[c]	-0.022	-0.069	-0.115[c]	-0.123[c]	0.041	-0.006	-0.054	-0.060[a]
	(0.577)	(0.142)	(0.006)	(0.002)	(0.665)	(0.114)	(0.004)	(0.001)	(0.410)	(0.889)	(0.166)	(0.093)
$Index\ Mutual\ Fund\ Own$	0.105[a]	0.065	0.054	0.061	0.096	0.048	0.025	0.030	0.151[c]	0.106[b]	0.067	0.060
	(0.074)	(0.181)	(0.220)	(0.149)	(0.107)	(0.334)	(0.589)	(0.477)	(0.003)	(0.014)	(0.109)	(0.135)
NOBS	463704	463587	463397	463063	463677	463535	463315	462950	443358	440940	438395	435692
R^2	0.029	0.050	0.070	0.090	0.029	0.050	0.071	0.090	0.031	0.059	0.085	0.110
$Hiah\ PMLIO \times Hiah\ HHI$	0.464[c]	0.399[c]	0.360[c]	0.331[c]	0.476[c]	0.417[c]	0.371[c]	0.346[c]	0.610[c]	0.472[c]	0.401[c]	0.355[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Low\ PMLIO \times Hiah\ HHI$	0.049[b]	0.040[a]	0.041[b]	0.041[b]	0.033	0.017	0.018	0.018	0.054[b]	0.047[b]	0.040[b]	0.041[b]
	(0.041)	(0.058)	(0.041)	(0.032)	(0.184)	(0.419)	(0.400)	(0.363)	(0.011)	(0.012)	(0.022)	(0.016)
$Hiah\ PMLIO \times Low\ HHI$	-0.186[b]	-0.176[b]	-0.161[b]	-0.152[b]	-0.219[b]	-0.218[c]	-0.195[c]	-0.181[c]	-0.150[a]	-0.134[b]	-0.110[a]	-0.099
	(0.022)	(0.014)	(0.015)	(0.013)	(0.010)	(0.004)	(0.006)	(0.006)	(0.063)	(0.049)	(0.078)	(0.101)
$ln(Amihud\ illia)$	0.772[c]	0.925[c]	0.952[c]	0.996[c]	0.772[c]	0.910[c]	0.964[c]	1.025[c]	0.432[c]	0.733[c]	0.839[c]	0.946[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.008)	(0.000)	(0.000)	(0.000)
$Residual\ \lvert r_{..}^{ETF}\rvert$	-0.122[b]	-0.108[b]	-0.106[c]	-0.112[c]	-0.117[b]	-0.099[b]	-0.096[c]	-0.101[c]	-0.139[c]	-0.102[c]	-0.088[c]	-0.083[c]
	(0.019)	(0.015)	(0.004)	(0.000)	(0.018)	(0.019)	(0.006)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
$Active\ Mutual\ Fund\ Own$	0.009	-0.034	-0.079[b]	-0.087[b]	0.014	-0.041	-0.091[b]	-0.102[c]	0.063	0.013	-0.039	-0.046
	(0.850)	(0.428)	(0.039)	(0.014)	(0.783)	(0.355)	(0.022)	(0.005)	(0.198)	(0.775)	(0.324)	(0.202)
$Index\ Mutual\ Fund\ Own$	0.060	0.024	0.022	0.031	0.058	0.011	-0.002	0.009	0.098[b]	0.058	0.023	0.017
	(0.304)	(0.621)	(0.628)	(0.481)	(0.296)	(0.822)	(0.968)	(0.825)	(0.044)	(0.171)	(0.563)	(0.663)

Stock Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Month Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Cluster by Stock and Month	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
NOBS	463704	463587	463397	463063	463677	463535	463315	462950	443358	440940	438395	435692
R^2	0.029	0.050	0.071	0.090	0.029	0.050	0.071	0.090	0.031	0.059	0.085	0.110

Appendix Table V
Robustness Test

Table reports two-way stock and month fixed effects regressions of stock return volatility, spread, and variance ratio on PMLIQ, ETF ownership, and residual $|r_{it}^{ETF}|$. For each firm, we estimate a time-series regression of $|r_{it}^{ETF}|$ on the dollar volume of purchases and sales by APs $dvol_{it}^{ETF}$ to compute residuals. Variable definitions can be found in Table II and Appendix Table I. Errors are clustered by stock and month. [a, b] and [c] denote 10%, 5% and 1% significant level, respectively. *p*-values are in parentheses. Coefficients on other control variables are reported in Appendix Table III.

	Volatility		**Spread**		***Var Ratio***		**$\lvert Var\ Ratio - 1\rvert$**		**Carhart (1997) 4-Factor Return Beta**		**Fama-French (2015)5-Factor Return Beta**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
$PMLIQ \times Low\_HHI$	-0.061[c]	-0.049[c]	-0.072[c]	-0.063[c]	0.009	0.010	0.009[b]	0.009[b]	-0.121[c]	-0.116[c]	-0.118[c]	-0.114[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.314)	(0.246)	(0.042)	(0.047)	(0.000)	(0.000)	(0.000)	(0.000)
$PMLIO \times Hiah\ HHI$	-0.059[c]	-0.044[c]	-0.074[c]	-0.064[c]	-0.010	-0.010	0.013[c]	0.013[c]	-0.098[c]	-0.095[c]	-0.100[c]	-0.096[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.220)	(0.264)	(0.003)	(0.005)	(0.000)	(0.000)	(0.000)	(0.000)
$ETF\ Own \times Low\ HHI$	0.040[c]	0.027[c]	0.002	0.001	0.011	0.011	-0.002	-0.002	0.019[a]	0.018[b]	0.020[b]	0.019[b]
	(0.000)	(0.000)	(0.750)	(0.811)	(0.154)	(0.131)	(0.668)	(0.614)	(0.052)	(0.047)	(0.015)	(0.017)
$ETF\ Own \times Hiah\ HHI$	0.044[c]	0.035[c]	0.011	0.009	-0.010	-0.011	-0.005	-0.006	0.079[c]	0.075[c]	0.068[c]	0.065[c]
	(0.000)	(0.000)	(0.199)	(0.179)	(0.209)	(0.181)	(0.234)	(0.207)	(0.000)	(0.000)	(0.000)	(0.000)
$ln(Amihud\ illia)$	0.185[c]	0.156[c]	0.220[c]	0.198[c]	-0.116[c]	-0.114[c]	0.054[c]	0.055[c]	0.060[c]	0.061[c]	0.080[c]	0.079[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Residual\ \lvert r_{..}^{ETF}\rvert$	0.007[c]	0.006[c]	0.010[c]	0.010[c]	-0.010[b]	-0.010[b]	-0.000	-0.001	0.032[c]	0.029[c]	0.029[c]	0.028[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.022)	(0.014)	(0.803)	(0.727)	(0.000)	(0.000)	(0.000)	(0.000)
$Active\ Mutual\ Fund\ Own$	0.001	0.004	-0.003	-0.000	0.016[c]	0.017[c]	-0.004[b]	-0.004[b]	0.012[c]	0.011[c]	0.015[c]	0.014[c]
	(0.856)	(0.241)	(0.315)	(0.972)	(0.000)	(0.000)	(0.037)	(0.044)	(0.005)	(0.008)	(0.000)	(0.000)
$Index\ Mutual\ Fund\ Own$	-0.014[c]	-0.006	-0.011[c]	-0.008[b]	-0.013[b]	-0.013[b]	-0.002	-0.002	0.010[a]	0.009	0.005	0.005
	(0.005)	(0.154)	(0.009)	(0.044)	(0.011)	(0.010)	(0.480)	(0.547)	(0.094)	(0.109)	(0.329)	(0.372)
$ln(RMCAP)$	-0.023[c]	-0.016[b]	0.009	0.012[b]	-0.035[c]	-0.033[c]	0.015[c]	0.014[c]	0.004	0.006	-0.012	-0.011
	(0.003)	(0.011)	(0.119)	(0.021)	(0.000)	(0.000)	(0.001)	(0.002)	(0.670)	(0.504)	(0.147)	(0.178)
Book/Market Ratio	0.019[c]	0.006	0.012[b]	0.007	-0.006	-0.005	0.003	0.003	-0.015[c]	-0.015[c]	-0.001	-0.002
	(0.002)	(0.272)	(0.013)	(0.132)	(0.272)	(0.315)	(0.215)	(0.290)	(0.004)	(0.002)	(0.864)	(0.782)
Rolling 12-month return	0.025[c]	0.007	0.026[c]	0.014[c]	-0.013[c]	-0.013[c]	0.001	0.001	0.006	0.007[a]	0.009	0.009
	(0.000)	(0.164)	(0.000)	(0.000)	(0.003)	(0.004)	(0.778)	(0.717)	(0.106)	(0.081)	(0.106)	(0.127)
CRSP Turnover	0.085[c]	0.045[c]	0.125[c]	0.104[c]	-0.009[a]	-0.009[a]	-0.005[b]	-0.005[a]	0.015[b]	0.016[c]	0.031[c]	0.030[c]
	(0.000)	(0.000)	(0.000)	(0.000)	(0.073)	(0.055)	(0.042)	(0.056)	(0.014)	(0.008)	(0.000)	(0.000)
Inverse Price	0.143[c]	0.097[c]	0.146[c]	0.108[c]	0.005	0.005	0.001	0.001	-0.001	-0.000	0.003	0.004
	(0.000)	(0.000)	(0.000)	(0.000)	(0.359)	(0.341)	(0.809)	(0.732)	(0.901)	(0.991)	(0.637)	(0.572)
Profitability	0.003	0.001	-0.007	-0.005	-0.017[c]	-0.017[c]	-0.000	-0.000	-0.010	-0.008	0.001	0.002
	(0.628)	(0.855)	(0.203)	(0.262)	(0.004)	(0.004)	(0.985)	(0.924)	(0.177)	(0.245)	(0.918)	(0.804)
DV: 1 Mo Lag	0.201[c]	0.151[c]	0.302[c]	0.232[c]	0.016[c]	0.016[c]	-0.003	-0.003	0.038[c]	0.036[c]	0.030[c]	0.028[c]

	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.208)	(0.178)	(0.000)	(0.000)	(0.000)	(0.000)
DV: 2 Mo Lag		0.123[c]		0.130[c]		0.009[c]		-0.003		0.035[c]		0.030[c]
		(0.000)		(0.000)		(0.000)		(0.216)		(0.000)		(0.000)
DV: 3 Mo Lag		0.168[c]		0.106[c]		0.010[c]		-0.003		0.029[c]		0.023[c]
		(0.000)		(0.000)		(0.000)		(0.219)		(0.000)		(0.000)
Stock Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Month Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Cluster by Stock and Month	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
NOBS	463133	456995	463109	456930	463133	456994	463133	456994	463091	456922	463057	456865
R^2	0.581	0.604	0.652	0.666	0.113	0.114	0.067	0.068	0.097	0.099	0.095	0.098