UNIVERSITY OF GOTHENBURG

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Does ETF Ownership Increase Stock Volatility?

Bachelor Thesis of Science in Financial Economics

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Spring 2019

Abstract

Exchange Traded Funds (ETFs) are supposed to be priced equal to the net asset value of their underlying stocks, if not, opportunities of arbitrage occur and are quickly corrected by arbitrageurs. When a demand or liquidity shock hits the ETF market, the price of the underlying stocks are affected due to arbitrage trading. This thesis explores the relationship between ETF ownership and the underlying stock volatility. We have conducted a similar research as Ben-David, Franzoni and Moussawi (2017a) but for the western European market, where we in addition investigate the importance of company size and the effect of crises. The results from the European ETF market show a negative relationship between ETF ownership and stock volatility, which contradicts precedent U.S. research. This relationship is also stronger for big companies, and in periods out of crisis.

Acknowledgements: We would like to express our gratitude to the centre of Finance at the University of Gothenburg for supplying us with the resources to conduct this research, and especially to our supervisor Marcin Zamojski for assistance and comments throughout the process. In addition, we would like to acknowledge the discussants Isak Djudja, Hugo Hammar, Philip Svensson, Joakim Nilsson, Filip Dahlfors and Stefan Padjen for helpful comments and discussions at seminars.

JEL Classification: G12, G14.

Keywords: Exchange Traded Fund, Stock Volatility, ETF ownership, Arbitrage

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1. Introduction

Exchange Traded Funds (ETFs) have increased in popularity in recent years. According to Bloomberg, ETFs now account for 25% of the daily trading volume in the U.S. stock market (Bloomberg, 2018). There are conflicting opinions regarding how and if ETFs affect the markets. Vanguard Group, which is the second largest provider of ETFs, posit that ETF ownership should not affect volatility due to the relatively small size of the ETF market compared to the overall financial assets (Vanguard 2018), whilst Ben-David et al. (2017a, 2017b), have found evidence of correlation between ETF ownership and stock volatility. Our results differ from the ones of Ben-David et al. (2017a), as we find a negative relationship between ETF ownership and the volatility of the underlying stocks. There seems to be differences in stock volatility sensitivity depending on the company size and also on the state the economy is in.

An ETF is a commodity that is similar to both a fund and a stock. It is a portfolio of securities that one can trade like a stock, i.e., it is possible to sell short, it is possible to lever, and ETFs are traded in liquid markets on a daily basis. The increased liquidity in comparison to mutual funds is likely to attract high frequency demand since they are easier to trade. If a demand shock makes the price of an ETF deviate from the Net Asset Value (NAV) of the ETF's portfolio, arbitrage opportunities occurs. Investors then, exploit the difference in price between the NAV and the ETF. This effect in turn propagates to the other underlying securities that are included in the ETF portfolio. Tax efficiency[1], higher liquidity and lower management fees are some of the benefits of buying ETFs instead of mutual funds. In addition, choosing ETFs over stocks simplifies diversification since ETFs consist of a basket of various securities (indices, commodities, bonds or stocks).

Deviation from the fundamental value of the ETF is affected by a demand or liquidity shock in the ETF market. These shocks could be due to new information arriving to the market. New information leads the investors to act rapidly and depending on its nature, more buy (sell) orders is conducted. Jones, Kaul and Lipson (1994) argue that it is the frequency of trades that affects the volatility, not the volume. Thus a stock with higher liquidity is then going to experience more volatility if the frequency of trades is what determines the

[1] Generally, ETFs create fewer taxable events (dividends, gains, exercising options) than mutual funds.

volatility. If the information is positive (e.g., the firm exceeds analysts revenue expectations) more buy orders would hit the market. This clustering of directional trade-orders is what Karpoff (1987) argues is determining price changes. Arbitrageurs locate the differences in price and exploit them until the price reverts back to fundamental value, i.e, equilibrium (see Figure A.1 in Appendix A). When a demand or a liquidity shock occurs in the ETF market, the effect propagates to all underlying securities. This may cause comovement of the securities in the ETF basket. The other way around, if a demand or liquidity shock hits one of the stocks in the basket, the price of that stock increases, making the ETF price increase and causes indirect demand for the residual stocks.

We investigate ETFs impact on volatility in the Western European market where no prior research regarding this issue exists to the best of our knowledge. There is indirect evidence that arbitrage is one of the main drivers of flows to and from ETFs and that it has an effect on volatility of the underlying assets. Ben-David et al. (2017a) conclude that further research regarding if and how arbitrage opportunities affect volatility is needed, and if there are other factors that influence the volatility. The National Best Bid and Offer (NBBO) is a Securities Exchange Commission regulation that obligates financial brokers to execute their trades at the best ask or bid price available. Ben-David et al. (2017a) show that the flows to ETFs are larger than the size of the flows in and out of the NBBO. When this occur, the orders (flows) need to access quotes that are wider than the spread of the NBBO. Ben-David et al. (2017a) point out that fundamental[2] flows play a smaller role, whilst the non-fundamental flows are the main driver of stock volatility. The flows and returns of ETFs move in the same direction and it is noted that the flows do not just cause a simple bid-ask bounce[3]. This suggests that the demand shock from flows to the ETFs causes movement up or down in the order book. In turn arbitrageurs always exploit these price fluctuations causing larger price movements.

[2] Fundamental flows are the intrinsic flows that occur due to trading. Non-fundamental flows are indirect flows which occurs when e.g. ETFs trades a stock, another stock in the ETF basket is then also bought to maintain the ETF price at fundamental value.
[3] A situation wherein the price bounces back and forth quickly within the limited range of the bid and the ask price.

2. Hypotheses

Most research regarding ETFs and their possible effect on the underlying securities focuses on the U.S. market. The main purpose of this thesis is, therefore, to perform a similar research for the Western European market in order to understand if the impact of the ETFs are similar to the results of U.S. research. In addition, we investigate if the effect of ETF ownership on the volatility of the underlying securities depends on the size of the companies. The sovereign debt crisis in 2009–2014 had a major impact on the European economy, and this thesis includes if this crisis, combined with the late stages of the global financial crisis of 2008, had any significant impact on how ETF ownership affects the volatility of the underlying securities. However, the main focus of this thesis is to test if there is a relationship between ETF ownership and volatility, which provide us with the following hypothesis.

I. There is a statistically significant relationship between ETF ownership and the volatility of the underlying stocks.

Furthermore firms of various sizes operate in different ways. In general, larger firms are considered more stable and less volatile in returns than smaller firms. Smaller firms are also, in general, younger, with a larger potential growth. Growth potential leads to speculation and higher valuation, but also higher risk, which induces trading on the potential up-side of the investment. Larger firms are traded more frequently since they are included in larger indices, ETFs, and various types of funds, in which more investors operate. ETFs usually track indices, where larger firms are included more frequently. This implies that the effect of ETF ownership on volatility could differ depending on the size of the company. Thus providing us with our second hypothesis.

II. There is a statistically significant difference in the relationship between ETF ownership and volatility for large and small companies.

Historically there have been a number of financial crises which have affected the market, both domestically, and on a global scale. A financial crisis will influence the trading, prices and the volatility (amongst other things), and the European sovereign debt crisis is a big part of our sample. It seems intuitive that this period will have a notable impact on our results,

which makes us believe that there will be visible differences in the relationship between ETF ownership and volatility during periods of crisis.

III. There is a statistically significant difference in relationship between ETF ownership and volatility during periods of crisis.

3. The mechanics of ETFs

Ben-David et al. (2017a) argue that ETFs have an incentive for liquidity trading, and that the ensuing price affects the underlying securities through arbitrage. They claim that stocks with higher ETF ownership should, *ceteris paribus*, exhibit higher volatility. The reasoning is as follows, if a liquidity shock hits the ETF market, arbitrageurs would try to absorb the liquidity demand by shorting the ETF after the shock influenced the ETF price. Risk aversion makes the arbitrageurs require compensation for the inventory in the ETF they are taking on, which makes the NAV of the underlying stocks price rise. The arbitrageurs then take a long position in the underlying securities that are in the ETF's basket in order to hedge their short ETF position. The prices of the underlying securities in the ETF basket will then rise to compensate the market makers, and all prices eventually revert to fundamentals (*See Figure A.1, Appendix A).* Authorized Personnel (AP) create new ETF shares when the ETF is overvalued on the market by buying the underlying securities and sell them as ETF shares, if APs believe that it is undervalued they do the opposite and buy ETF shares and then sell the underlying securities of each ETF share. This process keeps the ETF price in line with the NAV of the underlying securities and is known as the creation and redemption mechanism.

The price discovery[4] at the ETF level leads to price discovery at the underlying securities level. Li and Zhu (2016) present another mechanism through which ETFs may enhance price efficiency. They argue that arbitrageurs use ETFs to circumvent short-sale constraints at the stock level. The authors use data on short interest of ETFs to compute the indirect short interest that is applied to each individual stock through ETFs that hold it. They document that this measure of stock-level short interest predicts stock returns and conclude that ETFs help improve market efficiency through this channel.

[4] The overall process of setting the correct spot price on assets.

Investing in an ETF is a cost-effective alternative for investors that wants to make a directional bet on the market. Lettau and Madhavan (2016), Madhavan (2016), and Madhavan and Sobczyk (2016) argue that ETFs enhance financial markets by reflecting new information before prices of the underlying securities adjust. Their explanation for this is that investors make directional bets on indices, thus the ETFs ability to transmit new information into the market will not transmit shocks into the stocks, but rather promote price discovery, as long as arbitrage is frictionless. This means that the price discovery of the ETFs leads to price discovery at the underlying securities level as well.

Glosten, Nallareddy and Zou (2016) show that once a stock is included in an ETF, it absorbs information faster than without ETF ownership. The authors claim that the stock prices can be explained by systematic information being absorbed quicker due to an increased co-movement of stocks with their index.

Da and Shive (2014) argue that investors trade ETFs more actively on index related news. They find that stocks included in an index have higher co-movement in returns. APs trade the securities that are included in the basket of their ETFs, exploiting the arbitrage to bring the value back to fundamental (*see Figure 1, Appendix A*) which indicates higher return co-movement with the index and a lower level of idiosyncratic volatility. Thus, the stock level response is likely to be less prompt, and less sensitive to idiosyncratic earnings news.

4. Literature review

Ben-David et al. (2017a) look at ETFs between 2000 and 2015, that were listed on the U.S. exchanges with baskets containing only U.S. stocks. They use an index-switching[5] event as an instrument variable for ETF ownership and observe that the impact of switching indices is stronger in months when ETF ownership is greater, and that there is a stronger impact for stocks with a higher ratio of ETF ownership compared to those owned by hedge-funds and mutual funds. Because of potential correlation between ETF ownership and the omitted variables, an instrumental variable is used to estimate the causal effect.

[5] I.e a switch from Russell 1000 to Russell 2000 (or vice versa). The switching of index could affect the liquidity and attractiveness of the stock to be included in funds and/or ETFs.

Ben-David et al. (2017a) interpret information about the fact that ETFs attract investors, whose demand is transmitted on to the underlying securities through arbitrage. The fact that ETFs effect on volatility is weaker for stocks with higher limits of arbitrage[6], and the fact that the effect is stronger during times of intensified arbitrageur trading activity, is considered evidence of correlation between ETF arbitrage and stock volatility.

There seems to be similarities between the paper by Ben-David et al. (2017a) and others regarding the effect of ETFs on asset prices. The idea that the underlying securities in an ETFs basket co-move because of the ETF transmitting shocks into all stocks in the basket is also present in Da and Shive (2015). They indicate that there is a connection between ETF ownership and higher co-movement of the underlying securities.

L. Xu and X. Yin (2017) are investigating the ETFs and the indices which they track, and try to capture the interaction between the trading volume of ETFs and the volatility of the index. They find an upward trend on the index realized variance (S&P 500), where the slope gets steeper after the introduction of ETFs. They also find that the synchronic trading of S&P 500 ETFs to be of great importance when determining the volatility of the index. However, it can also affect each other with a time delay (two-way Granger causality). This is not only true for S&P 500 but also for various market indices. Their results are of interest since this phenomenon can help explain why ETFs affect the underlying securities volatility by looking at the trades and their volume. Their results of a steeper upward trend after ETFs were introduced indicates that they do have an effect on the volatility of the index, and consequently the volatility of the underlying stocks.

Chang et al. (2015) use the Russell 1000 and Russell 2000 indices to look for exogenous variation in ETFs ownership in stocks. They show a (2–3.5 times) larger amount of passively owned assets in the Russell 1000 (which includes the top 1000 firms by market capitalization from the Russell 3000) than in the Russell 2000 (which includes the bottom 2000 firms of the Russell 3000). Consequently, the top Russell 2000 stocks tracks a lot more passive money than the bottom of Russell 1000 according to Chang et.al (2015). They construct a cut-off (1000th-1001th stock in the Russell 3000) and find that there is a discontinuously higher ETF ownership to the right of the cut-off, than for stocks immediately to the left (*see Figure A.3 in*

[6] Stocks with low liquidity, short selling fees, and higher bid-ask spread.

Appendix A). The cut-off represent a change of index, this result is also present for index funds. To make sure that it is the ETF ownership, and not the index funds that drive their findings, they control for the index fund ownership. Their findings indicate that, when stocks transfer to a larger index, ETFs increases their ownership of that stock. It can be explained by the fact that many ETFs track indices, optimized replication, or that investors find stocks included in larger indices a safer investment. Ben-David et al. (2017) therefore control for this index-switching effect and use it as an instrumental variable in their regressions and find it highly significant.

The regressions from Ben-David et al. (2017a) show a positive and strongly significant relationship between ETF ownership and volatility. However, the relationship between ETF ownership and volatility is weaker for smaller stocks (Ben-David et al. 2017a), due to dilution of the effect when the sample includes smaller stocks[7]. This may be a result of optimized replication, i.e, that arbitrageurs choose to focus on the larger stocks in the ETF baskets when constructing a replicating portfolio in order to minimize transaction costs. Similarly, the ETFs mimic underlying indices as well as possible, but not exactly.

Ben-David et al. (2017a) do not control for firm fixed effects when performing their regressions with index-switching. Instead they only include time fixed effects when they perform their regressions on volatility. Their motivation for this is that their data is inherently cross sectional. They argue that when stocks jump from one index to another, invalid effects on volatility might occur only because of the membership of another index. Membership in larger indices leads to higher investor interest, and more liquidity, and trading. They show that changing index has a strong impact on ETF ownership. They find a significant relationship between ETF ownership and volatility in all regressions even if the index-switching event is included or not.

When stocks change from a small-cap to a large-cap index, their ETF ownership increases, and the IV estimates captures the effect of this. Ben-David et al. (2017a) also find a relation between adjusted churn ratio[8] and ETF ownership, which follows the conjuncture that ETFs

[7] When regressions are made using the sample with stocks from the Russell 3000 index instead of stocks from S&P 500.

[8] The churn ratio used by Ben-David et al. (2017a) takes a number between 1 and 0, and measures trades made in a certain period of time. If there are more sell trades than buy trades, or the opposite, the value will be closer to 0. If there are an equal number of buy and sell trades, the value will be equal to 1.

attract a high-turnover clientele. This would support that high-turnover investors make bigger investments in a stock when the ETF ownership for that specific stock is high. They also conclude that after a price increase in the ETF, due to a demand shock, the price of the underlying stock will follow the price of the ETF and then stay at the new level.

Ben-David et al. (2017a) conclude that ETFs are very beneficial for investors due to the high liquidity and low cost. However, the ease of trade could lure in new high frequency investors who can cause demands shocks to the underlying securities of the ETFs. The fact that stocks with higher ETF ownership display higher volatility than other similar securities with lower ETF ownership is one of the papers main findings. The interpretation of this, with the help of a quasi-natural experiment[9], is that ETFs do have an effect on the volatility of the underlying securities. Regarding the demand shocks in the ETF market, they impound a mean-reverting component in the asset prices. Ben-David et al. (2017) point out that non-fundamental demand shocks in the ETF market affect the prices of the underlying stocks via arbitrage. The ETFs effect on volatility is inflated due to the intensity of arbitrage activity between ETFs and their baskets.

5. Method

If liquidity and demand shocks in the ETF market have an effect on the underlying securities, there should be a larger effect if the ETF ownership is higher. In order to test this we look at ETF ownership for each stock and try to capture the effect of it. The ETF ownership show how much of the underlying stock that is owned by ETFs, in percentages. Ben-David et al. (2017a) present (1) as the basis for the regressions to test whether ETF ownership leads to higher volatility of the underlying securities. The formula provides us with three sources of variation in ETF ownership which potentially could be correlated with stock volatility.

$$ETF\ Ownership_{i,t} = \frac{\sum_{j=1}^{J} w_{i,j,t} AUM_{i,j}}{Mkt\ Cap_{i,j}} \qquad (1)^{10}$$

[9] A quasi-experiment is an empirical interventional study used to estimate the causal impact of an intervention on target population without random assignment.

[10] i = stock, t = value of holdings by all ETFs investing in the stock, Mkt Cap = the stock's market capitalization, J = set of ETFs holding stock I, $w_{i,j,t}$ = weight of the stock in the portfolio of ETF j, AUM (Assets under management)$_{j,t}$ = AUM of ETF j at the end of the month.

Once we calculate ETF ownership using ep. (1) we use it as the main regressor in our first regression. Our regressand, standardized volatility, is computed by finding the returns (2) and the realized volatility over 1 month (3) using daily data. This provides us with the daily volatility of stock *i*.

$$\delta_n = \ln\left(\frac{C_n}{C_{n-1}}\right) \qquad (2)$$

$$\sigma = \sqrt{\sum \delta^2{}_{i,t}} \qquad (3)$$

In addition, we include the lagged volatility as a control variable. Firm fixed effects account for other cross sectional differences between the stocks, e.g. some firms operate in more volatile markets than others. The time fixed effects captures effects of periods of higher/lower volatility. Inclusion of fixed effects helps remove omitted variable bias.

$$Standardized\ Volatility = Standardized\ ETF\ Ownership + Control\ Variables + Lagged\ Volatility + Fixed\ Effects + \varepsilon_i$$

When testing if there is a statistically significant difference in the relationship between ETF ownership and volatility for large and small companies, a similar regression is made with the addition of a dummy variable. There is a cut-off based on market cap at €3.6 billion, where the companies with higher market cap than the cut-off are assigned 1, while the companies with smaller market capitalization than the cut-off are assigned 0. We base this cut-off on the smallest company on S&P 500 and the 500th company on the STOXX Europe 600 index.

The third hypothesis is tested by using two similar but different methods. In the first method, we divide our sample into two parts; "in crisis" and "out of crisis". Within the "in crisis" sample we include the European sovereign debt crisis of 2009-10-01–2014-03-31 and also the end of the global financial crisis of 2008-02-01–2009-03-31. By having one sample where all data included are from the periods of crisis, and the other sample only including data from periods out of crisis, we are able to compare the two samples. The second method is similar, but the full sample is intact and a dummy variable is used in order to classify if the specific information comes from a period in or out of crisis. In order to test for significance, the dummy variable is used as an interaction variable together with ETF ownership.

6. Data Collection

We follow the approach of Ben-David et al. (2017a) who work with U.S. data, but instead we focus on Western Europe. ETFs are a relatively new financial product, so data availability is lower compared to that for equities or mutual funds. Consequently, there are no data available prior to 2005 for this region. We see a spike in ETF ownership in 2009 (*see Figure A.2 and A.4 in Appendix A*). This may be a result of several ETFs not reporting their holdings before, or that they did not even exist prior to 2009. Thus, we restrict our sample to a period of 10 years, starting in the end of 2008 up until 2019. We use Bloomberg to retrieve data for different ETFs and their reported stock holdings. We consider a sample size of 64 ETFs that invest in Western Europe, all of which have a large basket of securities. Ben-David et al. (2017a) use a sample size of 454 ETFs and use a time horizon of 15 years. Our sample size is smaller due to limited time.

The sample data is collected using Bloomberg where we focus on Western Europe ETFs with at least a reported 10-year performance. We look at their holdings and retrieve monthly market values from the holdings analysis. For the underlying stocks we retrieve the daily market capitalization, which is our variable of interest and it will be used to compute the ETF ownership. Since our sample size only consists of ETFs that have at least a 10-year performance, there is a possibility for survivorship bias, i.e we only look at the ETFs that survived for at least 10 years. This means that our sample might be overestimating the actual performance of ETFs during this period of time. This is of great matter especially during the period of crisis, where the ETFs who did not make it through the crisis are overlooked. However, the survivorship bias does not only mean that poor performing ETFs that have not survived are excluded. It can also mean that high-performing ETFs that have not been on the market for ten years are excluded from the sample because of the 10-year performance limitation.

The final sample contains 64 different ETFs and 1206 underlying stocks. The names are matched to the tickers of stocks in 26 large indices in the European zone. Collection of daily stock returns in order to calculate the daily stock volatility, market capitalization for each stock, volume, EBIT, bid-ask spread, total assets and daily stock prices is collected to use for calculations of our control variables, ETF ownership and volatility.

Table 1. Summary statistics for our full sample

Variable	Obs	Mean	Std. Dev.	Min	Max
Standardized Volatility	122269	0.0000	1	-0.9762	67.5074
ETF Ownership	78355	0.0032	0.0061	0.0000	0.2780
Log Market Cap	121315	7.6917	1.9581	0.1027	14.5882
Inverted Price	121122	0.1939	2.5448	0.0000	172.4138
Amihud	115510	0.0000	0.0002	0.0000	0.0413
bid-ask-spread	78746	2.1444	17.9446	0.0005	4081.7160
Gross Profitability	100482	0.0332	0.1367	-3.1544	11.7750
Absolute Returns	121111	10.1667	78.0623	0.0000	11532

7. Results

Table 2. ETF ownership

*The table shows estimates from ordinary least squares (OLS) regressions of monthly standardized volatility on ETF ownership and controls. T-statistics are presented in parentheses. ***, ** and * represent statistical significance at the 1%, 5%, and 10% levels respectively. The variables are lagged tm1 (t-1), (t-2) and (t-3). The sample ranges between 2008-09-30 to 2019-01-31.*

Dependent Variable	Standardized Volatility							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
standardized etf share owned	-0.0320	-0.0340	-0.0315	-0.0334	0.0039	0.0056	0.0037	0.0055
	(-3.02)	(-4.41)	(-3.04)	(-4.39)	(0.37)	(0.65)	(0.36)	(0.63)
	***	***	***	***				
log mkt cap tm1	-0.0617	-0.0593	-0.0607	-0.0586	-0.2029	-0.1415	-0.2014	-0.1416
	(-9.43)	(-8.07)	(-9.61)	(-8.10)	(-6.84)	(-3.59)	(-6.76)	(-3.58)
	***	***	***	***	***	***	***	***
inv price tm1	0.0294	0.3561	0.0286	0.3496	0.1002	1.0680	0.1001	1.0686
	(1.06)	(1.44)	(1.06)	(1.43)	(1.46)	(3.20)	(1.45)	(3.20)
						***		***
amihud tm1	1040.6480	-169.9727	970.3847	-170.2014	358.7243	-97.9647	345.1266	-98.8869
	(0.98)	(-1.52)	(0.98)	(-1.54)	(0.70)	(-1.21)	(0.70)	(-1.23)
abs returns tm1	0.0003	0.0005	0.00	0.0005	0.0001	0.0002	0.0001	0.0002
	(2.77)	(2.94)	(2.69)	(2.77)	(2.33)	(1.35)	(2.08)	(1.31)
	***	***	***	***	**		**	
bid ask spread tm1		0.0022		0.0023		-0.0010		-0.0010
		(1.21)		(1.30)		(-0.45)		(-0.43)
gross profitability tm1		-0.2353		-0.2399		0.2684		0.2656
		(-1.12)		(-1.19)		(1.11)		(1.10)
standardized volatility tm1			0.0728	0.0404			0.0383	0.0054
			(2.69)	(2.00)			(1.70)	(0.66)
			***	**			*	
standardized volatility tm2			0.0548	0.0423			0.0211	0.0078
			(4.19)	(2.62)			(3.06)	(1.11)
			***	***			***	
standardized volatility tm3			0.0432	0.0331			0.0107	-0.0008
			(3.44)	(2.18)			(1.72)	(-0.14)
			***	**			*	
cons	0.4175	0.3396	0.4120	0.3367	1.5784	0.9722	1.5663	0.9731
	(6.84)	(4.93)	(6.97)	(4.98)	(6.37)	(3.05)	(6.30)	(3.05)
	***	***	***	***	***	***	***	***
Time-fixed effects	False	False	False	False	True	True	True	True
Firm-fixed effects	False	False	False	False	True	True	True	True
N	75523	45212	75319	45143	75523	45184	75317	45113
Adjusted R^2	0.0241	0.0322	0.0326	0.0352	0.1945	0.1957	0.1962	0.1957

In Table 2, all regressions without fixed effects (columns (1) to (4)) show significance on the 1% level for ETF ownership with a negative coefficient that does not vary much. In Table 2, a one standard deviation increase of ETF ownership leads to a decrease of volatility by between 3.15% and 3.34% of a standard deviation. When adding fixed effects (columns (5) to (8)) the ETF ownership becomes insignificant. It is important to point out that time fixed effects do not affect the results, but the inclusion of firm fixed effects have a major impact. The firm fixed effects account for the differences between companies that are stable in time. Logged market capitalization is significant at 1% no matter if we apply fixed effects or not. Without fixed effects both absolute returns and the three lagged volatilities are significant in columns (1) to (4), however there are other interesting findings when looking at our control variables. When applying fixed effects (columns (5) to (8)), absolute returns are only significant in columns (5) and (7) where the bid-ask spread and gross profitability are excluded. The opposite can be said for the inverse of the price as this control variable only become significant when bid-ask spread and gross profitability are included. An important fact that needs to be considered is the size of the coefficient for absolute returns, since it is close to zero. It can therefore be discussed whether this effect is economically significant. Table 2 is a compressed version of Table B.5 in Appendix B. In Table B.5 in Appendix B sixteen regressions are made where we in addition include time fixed and firm fixed effects separately.

Table 3 ETF ownership with "Big" dummy variable

*The table shows estimates from ordinary least squares (OLS) regressions of monthly standardized volatility on ETF ownership with "big" as interaction variables, and controls. T-statistics are presented in parentheses. ***, ** and * represent statistical significance at the 1%, 5%, and 10% levels respectively. The lagged variables (tm1) are lagged 1, 2, or 3 months. The sample ranges between 2008-09-30 to 2019-01-31.*

Dependent Variable	Standardized Volatility							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
big# ETF Ownership 0	-0.0229	-0.0334	-0.0227	-0.0330	0.0089	0.0153	0.0087	0.0151
	(-1.60)	(-2.76)	(-1.62)	(-2.76)	(0.77)	(1.26)	(0.78)	(1.25)
		***		***				
big# ETF Ownership 1	-0.0461	-0.0346	-0.0450	-0.0338	-0.0139	-0.0169	-0.0141	-0.0171
	(-4.22)	(-4.05)	(-4.23)	(-4.04)	(-1.15)	(-1.69)	(-1.17)	(-1.71)
	***	***	***	***		*		*
log mkt cap tm1	-0.0619	-0.0593	-0.0609	-0.0586	-0.2032	-0.1420	-0.2016	-0.1420
	(-9.48)	(-8.07)	(-9.66)	(-8.10)	(-6.85)	(-3.60)	(-6.77)	(-3.60)
	***	***	***	***	***	***	***	***
inv price tm1	0.0293	0.3562	0.0285	0.3497	0.1003	1.0692	0.1001	1.0697
	(1.06)	(1.44)	(1.06)	(1.43)	(1.46)	(3.20)	(1.45)	(3.20)
						***		***
amihud tm1	1042.3100	-169.7787	972.0534	-170.0533	357.6203	-100.7711	344.0276	-101.6868
	(0.98)	(-1.52)	(0.98)	(-1.53)	(0.70)	(-1.27)	(0.70)	(-1.28)
abs returns tm1	0.0003	0.0005	0.0003	0.0005	0.0001	0.0002	0.0001	0.0002
	(2.75)	(2.95)	(2.67)	(2.77)	(2.33)	(1.35)	(2.09)	(1.31)
	***	***	***	***	**		**	
bid ask spread tm1		0.0022		0.0023		-0.0010		-0.0010
		(1.21)		(1.30)		(-0.44)		(-0.42)
gross profitability tm1		-0.2355		-0.2400		0.2729		0.2701
		(-1.12)		(-1.19)		(1.12)		(1.12)
standardized volatility tm1			0.0728	0.0404			0.0382	0.0053
			(2.69)	(2.00)			(1.70)	(0.66)
			***	**			*	
standardized volatility tm2			0.0547	0.0423			0.0211	0.0077
			(4.19)	(2.62)			(3.06)	(1.11)
			***	***			***	
standardized volatility tm3			0.0431	0.0331			0.0107	-0.0008
			(3.44)	(2.18)			(1.71)	(-0.15)
			***	**			*	
cons	0.4193	0.3396	0.4137	0.3367	1.5803	0.9760	1.5682	0.9770
	(6.88)	(4.93)	(7.01)	(4.98)	(6.39)	(3.06)	(6.31)	(3.06)
	***	***	***	***	***	***	***	***
Time-fixed effects	False	False	False	False	True	True	True	True
Firm-fixed effects	False	False	False	False	True	True	True	True
N	75523	45212	75319	45143	75523	45184	75317	45113
Adjusted R^2	0.0243	0.0321	0.0328	0.0352	0.1946	0.1958	0.1962	0.1958

In Table 3, ETF ownership is significant for big companies without fixed effects (columns (1) to (4)), and a one standard deviation increase of ETF ownership leads to a decrease of volatility by between 3.38% and 4.61% of a standard deviation. For small companies, ETF ownership is only significant in columns (2) and (4) where the liquidity measures are included and fixed effects are excluded. However, the magnitude of the relationship between ETF ownership and standardized volatility varies. A one standard deviation increase of ETF ownership leads to a decrease of volatility by between 3.30% and 3.34% of a standard deviation. The inclusion of fixed effects, especially firm fixed effects, causes insignificance for ETF ownership and the variable is now only significant in columns (6) and (8) for big companies, where the liquidity measures are included. The results of the control variables are very similar to the results from Table 2, where logged market capitalization is significant in all columns.

Table 4. ETF ownership with "Crisis" dummy variable

*The table shows estimates from ordinary least squares (OLS) regressions of monthly standardized volatility on ETF ownership with "crisis" as an interaction variable, and controls. T-statistics are presented in parentheses. ***, ** and * represent statistical significance at the 1%, 5%, and 10% levels respectively. The variables are lagged tm1 (t-1), (t-2) and (t-3). The sample ranges between 2008-09-30 to 2019-01-31.*

Dependent Variable	Standardized Volatility							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
crisis# ETF Ownership 0	-0.0356	-0.0401	-0.0351	-0.0393	0.0033	0.0021	0.0031	0.0020
	(-3.34)	(-5.42)	(-3.41)	(-5.41)	(0.28)	(0.29)	(0.27)	(0.27)
	***	***	***	***				
crisis# ETF Ownership 1	-0.0272	-0.0179	-0.0266	-0.0177	0.0044	0.0128	0.0043	0.0127
	(-1.51)	(-1.20)	(-1.52)	(-1.21)	(0.36)	(0.78)	(0.35)	(0.77)
log mkt cap tm1	-0.0617	-0.0594	-0.0607	-0.0586	-0.2028	-0.1409	-0.2013	-0.1410
	(-9.42)	(-8.08)	(-9.60)	(-8.11)	(-6.84)	(-3.59)	(-6.77)	(-3.58)
	***	***	***	***	***	***	***	***
inv price tm1	0.0294	0.3554	0.0286	0.3490	0.1002	1.0685	0.1001	1.0691
	(1.06)	(1.43)	(1.06)	(1.43)	(1.46)	(3.20)	(1.45)	(3.20)
						***		***
amihud tm1	1040.1810	-171.3703	969.9138	-171.5710	358.8008	-98.0383	345.2045	-98.9639
	(0.98)	(-1.53)	(0.98)	(-1.55)	(0.70)	(-1.21)	(0.70)	(-1.23)
abs returns tm1	0.0003	0.0005	0.0003	0.0005	0.0001	0.0002	0.0001	0.0002
	(2.76)	(2.94)	(2.68)	(2.77)	(2.33)	(1.35)	(2.08)	(1.31)
	***	***	***	***	**		**	
bid ask spread tm1		0.0022		0.0023		-0.0010		-0.0010
		(1.22)		(1.30)		(-0.44)		(-0.42)
gross profitability tm1		-0.2351		-0.2396		0.2711		0.2683
		(-1.12)		(-1.19)		(1.12)		(1.11)
standardized volatility tm1			0.0728	0.0404			0.0383	0.0054
			(2.69)	(2.00)			(1.70)	(0.66)
			***	**			*	
standardized volatility tm2			0.0548	0.0423			0.0211	0.0077
			(4.19)	(2.62)			(3.06)	(1.11)
			***	***			***	
standardized volatility tm3			0.0432	0.0330			0.0107	-0.0008
			(3.44)	(2.18)			(1.71)	(-0.15)
			***	**			*	
cons	0.4174	0.3398	0.4119	0.3369	1.5778	0.9669	1.5657	0.9679
	(6.84)	(4.94)	(6.97)	(4.99)	(6.38)	(3.05)	(6.31)	(3.04)
	***	***	***	***	***	***	***	***
Time-fixed effects	False	False	False	False	True	True	True	True
Firm-fixed effects	False	False	False	False	True	True	True	True
N	75523	45212	75319	45143	75523	45184	75317	45113
Adjusted R^2	0.0241	0.0323	0.0326	0.0353	0.1945	0.1957	0.1962	0.1957

In Table 4 ETF Ownership is only significant out of crisis without fixed effects (columns (1) to (4)). A one standard deviation increase of ETF ownership leads to a decrease of volatility by between 3.51% and 4.01% of a standard deviation, and there is significance at a 1% level in all four cases. The "in-crisis" ETF ownership coefficient is never significant, which indicates that there is no significant effect of ETF ownership on volatility during the period in

crisis. The results of the control variables are yet again very similar to the results from Table 2, where logged market capitalization is significant in all columns.

Table 5. ETF ownership with "Crisis" and "Big" interaction terms

*The table shows estimates from ordinary least squares (OLS) regressions of monthly standardized volatility on ETF ownership with "big" and "crisis" as interaction variables, and controls. T-statistics are presented in parentheses. ***, ** and * represent statistical significance at the 1%, 5%, and 10% levels respectively. The variables are lagged tm1 (t-1), (t-2) and (t-3). The sample ranges between 2008-09-30 to 2019-01-31.*

Dependent Variable	Standardized Volatility							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
crisis#big# ETF Ownership 0 0	-0.0297	-0.0389	-0.0297	-0.0383	0.0068	0.0098	0.0065	0.0097
	(-1.86)	(-3.83)	(-1.94)	(-3.85)	(0.46)	(1.11)	(0.46)	(1.10)
	*	***	*	***				
crisis#big# ETF Ownership 0 1	-0.0443	-0.0416	-0.0430	-0.0406	-0.0114	-0.0192	-0.0115	-0.0193
	(-4.53)	(-4.43)	(-4.54)	(-4.42)	(-0.81)	(-1.47)	(-0.82)	(-1.48)
	***	***	***	***				
crisis#big# ETF Ownership 1 0	-0.0139	-0.0092	-0.0135	-0.0092	0.0112	0.0405	0.0111	0.0403
	(-0.64)	(-0.24)	(-0.64)	(-0.25)	(0.84)	(1.12)	(0.85)	(1.12)
crisis#big# ETF Ownership 1 1	-0.0486	-0.0223	-0.0478	-0.0219	-0.0164	-0.0128	-0.0166	-0.0130
	(-2.83)	(-2.14)	(-2.87)	(-2.13)	(-1.21)	(-1.20)	(-1.24)	(-1.22)
	***	**	***	**				
log mkt cap tm1	-0.0619	-0.0593	-0.0609	-0.0586	-0.2029	-0.1406	-0.2014	-0.1406
	(-9.48)	(-8.09)	(-9.67)	(-8.12)	(-6.85)	(-3.60)	(-6.78)	(-3.59)
	***	***	***	***	***	***	***	***
inv price tm1	0.0294	0.3560	0.0285	0.3495	0.1003	1.0706	0.1001	1.0711
	(1.06)	(1.43)	(1.06)	(1.43)	(1.46)	(3.20)	(1.45)	(3.20)
						***		***
amihud tm1	1042.2940	-170.6754	972.0404	-170.9335	357.9312	-101.2357	344.3456	-102.1551
	(0.98)	(-1.53)	(0.98)	(-1.54)	(0.70)	(-1.27)	(0.70)	(-1.29)
abs returns tm1	0.0003	0.0005	0.0003	0.0005	0.0001	0.0002	0.0001	0.0002
	(2.75)	(2.94)	(2.67)	(2.77)	(2.34)	(1.36)	(2.09)	(1.32)
	***	***	***	***	**		**	
bid ask spread tm1		0.0022		0.0023		-0.0010		-0.0010
		(1.21)		(1.30)		(-0.45)		(-0.42)
gross profitability tm1		-0.2356		-0.2401		0.2812		0.2784
		(-1.13)		(-1.19)		(1.15)		(1.14)
standardized volatility tm1			0.0728	0.0404			0.0382	0.0053
			(2.69)	(2.00)			(1.70)	(0.66)
			***	**			*	
standardized volatility tm2			0.0547	0.0422			0.0211	0.0077
			(4.19)	(2.62)			(3.06)	(1.11)
			***	***			***	
standardized volatility tm3			0.0431	0.0330			0.0107	-0.0008
			(3.44)	(2.18)			(1.71)	(-0.16)
			***	**			*	
cons	0.4192	0.3395	0.4136	0.3367	1.5785	0.9639	1.5663	0.9650
	(6.88)	(4.94)	(7.01)	(4.99)	(6.39)	(3.05)	(6.32)	(3.05)
	***	***	***	***	***	***	***	***
Time-fixed effects	False	False	False	False	True	True	True	True
Firm-fixed effects	False	False	False	False	True	True	True	True
N	75523	45212	75319	45143	75523	45184	75317	45113
Adjusted R^2	0.0243	0.0323	0.0328	0.0353	0.1946	0.1959	0.1962	0.1959

Table 5 includes a double (both “big” and “crisis”) interaction with ETF ownership. There is no significance for ETF ownership in columns (5) to (8) where fixed effects are included. However, we find significance for ETF ownership in columns (1) to (4) for big companies in and out of crisis, and small companies out of crisis. This means that the size of the company matters for the significance of ETF ownership when in a period of crisis. There seems to be a stronger negative effect for big companies in periods out of crisis than periods in crisis. For big companies in crisis in columns (2) and (4) a one standard deviation increase of ETF ownership leads to a decrease of volatility by between 2.19% and 2.23% of a standard deviation. When looking at the same columns but for big companies out of crisis there is a stronger negative relationship between ETF ownership and standardized volatility, where a one standard deviation increase of ETF ownership leads to a decrease of volatility by between 4.06% and 4.16% of a standard deviation. This means that there is a stronger relationship between ETF ownership and standardized volatility for big companies in periods out of crisis, than periods in crisis. When looking at the control variables, the results are similar to Table 2.

We reproduce the regressions from Table 2 and Table 3 with a split sample. One part of the sample only includes the periods in crisis, and the other sample only includes the periods out of crisis. This means that we now only use the “big” dummy variable as an interaction variable with ETF ownership.

In Table B.1 in Appendix B , where our dataset only includes data from the periods in crisis, there is no significance for ETF ownership. When comparing this to Table 2 we find that absolute returns now is significant in all columns. There is also a difference in the significance of lagged volatility. No matter if fixed effects are included or not, there are fewer lagged volatility variables that are significant than in Table 2. An interesting finding is that the inverse of the price no longer is significant in columns (6) and (8), but now is significant in columns (1) to (4), and columns (5) and (7). This is the complete opposite from the results reported in Table 2.

When we include “big” as an interaction variable with ETF ownership in Table B.2 in Appendix B, we do not find any significance for small companies in the “in-crisis” dataset. However, the coefficient for ETF ownership is significant for big companies in columns (1) to (4) where fixed effects are excluded, and also in columns (6) and (8) where fixed effects and liquidity measures are included. When comparing these results to Table 3 there are some

interesting findings. In Table B.2 in Appendix B the magnitude of the negative relationship between ETF ownership and standardized volatility in columns (1) to (4) is weaker, but in columns (6) and (8) the magnitude of the relationship is stronger.

When comparing the results in Table B.2 in Appendix B to Table 5 there is an interesting difference in columns (6) and (8). In the dataset only including periods in crisis there is significance of ETF ownership in both columns. However, in Table 5 where the dataset includes the full sample and we instead use "crisis" as an interaction variable, there is no significance for ETF ownership in regressions including fixed effects (columns (5) to (8)).

In Table B.3 in Appendix B , where our dataset only includes data from the periods out of crisis, the results are quite similar to the results in Table 2, where ETF ownership is significant when no fixed effects are applied, and logged market capitalization is significant on a 1% level in all regressions. However, the significance level for absolute returns is different compared to earlier output. It is only significant when the liquidity measures and fixed effects are excluded. The lagged volatility and the inverse of price is significant in the same scenarios as Table 2.

In Table B.4 in Appendix B, being a big company out of crisis results in a larger negative effect than for small companies. There is significance for ETF ownership for both big and small companies, similar to the results from Table 3. The differences is larger when the liquidity measures and fixed effects are excluded. ETF ownership gains significance for small companies in columns (1) and (3), but columns (6) and (8) for big companies are no longer significant. However, there are no noteworthy changes in the coefficients.

8. Robustness

The way we perform our regressions is a well-known approach to find what factors influence the dependent variable. We add and remove control variables in order to capture their specific effect on the standardized volatility, as discussed in the previous section. In Table B.1 to B.4 in Appendix B, we perform another method of a robustness check where we divide our sample. The split sample regressions alter our explanatory variables to fit either "in crisis" or "out of crisis", which will affect all estimators.

In addition we perform a robustness test where we use a similar method as L. Xu and X. Yin (2017). We compute our regressions again, this time with realized variance as our dependent variable instead of standardized volatility. Variance and volatility is both used to measure the movement of an assets returns from the mean. Variance is not necessarily bound by any time period, whilst volatility is a measure of the standard deviation over a certain time interval. Both terms are used interchangeably in finance to determine the risk factor. We therefore include it to see if the regressions provide us with similar results when looking at two resembling measurements of risk.

In Table B.6 in Appendix B, which is a replication of Table 2, we find a weaker negative relationship between ETF ownership and our dependent variable. The ETF ownership is significant in columns (1) to (3), but insignificant in columns (4) to (8). Except for ETF ownership being insignificant in column (4), the results corroborates to our results in Table 2 in terms of significance. However, when we compare Table B.7 in Appendix B to Table 5, where both "big" and "crisis" are included as interaction variables with ETF ownership, the significance differs. There is no longer any significance for small companies, no matter if it is a period in crisis or not. When looking at big companies out of crisis, the results regarding significance corroborates to the results in Table 5. However, for big companies in crisis there are some findings that are hard to interpret. In Table B.7 in Appendix B, we find significance for ETF ownership for big companies in crisis, but only when the liquidity measures are excluded (columns (1) and (3)). Even when fixed effects are included the variable is significant (columns (5) and (7)), and the relationship between ETF ownership and realized variance is also stronger for these two columns than column (1) and (3) without fixed effects.

For the dataset only including data from periods in crisis (Table B.8 in Appendix B), ETF ownership for big companies is significant in columns (1), (2) and (4). Small companies are never significant and the large companies only matters when fixed effects is excluded. This corroborates to our findings regarding the volatility, except for column (3) where significance is lost when looking at realized variance.

For the dataset only including data from periods out of crisis (Table B.9 in Appendix B), ETF ownership for big companies is only significant in columns (1) and (3) where neither fixed effects nor liquidity measures are included.

Overall there seems to be a significant relationship between lagged standardized volatilities and realized variance when fixed effects and all control variables are applied. This is not the case for the regressions where standardized volatility is the dependent variable. The biggest difference when looking at control variables is logged market capitalization. When volatility is the dependent variable there is significance for logged market capitalization in all regressions. When we instead use realized variance as the dependent variable, the logged market capitalization is only significant in columns (1) and (3). This is the scenarios where there are no fixed effects applied and bid-ask spread and gross profitability are excluded.

We winsorized the data to see if removing outliers made any significant differences in our regressions. We created winsor variables on the 1% and 5% level, the regressors does not become significant and the coefficients barely change. Thus we conclude that no outliers affect our sample in any significant way.

9. Analysis

Our results do not corroborate to the findings of Ben-David et al. (2017a). In contradiction to the positive relationship between ETF ownership and volatility that is presented by Ben-David et al. (2017a) we find a negative relationship whose significance is questionable. This is a finding that might be explained by market and regional differences between the U.S. and Europe. The size of the ETF market in Europe is just a fraction of the ETF market in the U.S. (Investment Europe, 2019). 40% of the ETF holdings in our sample are companies that are big enough to fit into S&P 500, which suggests that the European ETFs are investing in bigger companies that essentially have a lower volatility. The small firm effect posits that larger firms tend to be less volatile than smaller ones. This is due to a better established firm being less exposed to fluctuations in the market while the small firms have higher growth opportunities which leads to larger future return expectations, thus making the price of the stock more volatile.

The logged market capitalization coefficient is negative and is significant (at the 1% level) for all our regressions. This corresponds to the small firm effect, that there is a significant negative relationship between the size of a firm and its volatility. When looking at Table 3, the output indicates that there is a negative relationship between ETF ownership and volatility. The relationship is significant in six out of eight cases for big companies, but only

two out of eight cases for small companies. This in combination with a stronger relationship for big companies yet again suggests that the size of a company matters. These results corroborates, to some extent, to the findings of Ben-David et al. (2017a) where the relationship between ETF ownership and volatility is weaker for small companies than for big companies. However, the relationship is negative in our findings which contradicts the positive relationship found by Ben-David et al. (2017a). ETF ownership being significant more frequently for big companies could also be explained by optimized replication. When investors try to replicate the ETF portfolio, smaller stocks are often overlooked in order to keep transaction costs as low as possible.

When testing Hypothesis I in Table 2, there is significance for ETF ownership at the 1% level whenever fixed effects are excluded. According to Table B.5 in Appendix B, time fixed effects do not affect the results that much and there is still significance at the 1% level. However, when firm fixed effects are applied the significance for ETF ownership is lost. The firm fixed effects capture cross-sectional differences between companies that are stable in time. ETF ownership could be driven by something that also drives volatility, and this may be the cause as to why including firm fixed effects wipe out significance.

When comparing the split samples “out of crisis” and “in crisis” we notice that coefficients and significance differ. In crisis there is no significance for small companies, whereas significance is found for both small and big companies in the “out of crisis” sample. This suggests that the ETF ownership does not affect the volatility of small companies in periods of crisis. In a period of crisis, other factors could affect small companies more than they affect big companies which in turn negates the relationship between ETF ownership and volatility. Investment behaviour change within periods of crisis, causing the number of investments to decrease. The investments made will most likely be investments with low risk, which will affect smaller companies the most. In a comparison between Table B.1 and Table B.3 in Appendix B, the relationship between ETF ownership and volatility is insignificant in the dataset where only periods in crisis are included. For the dataset in which only periods out of crisis are included the relationship is significant at the 1% level whenever fixed effects are excluded. This is in line with hypothesis III, since there is a significant difference in the relationship between ETF ownership and volatility for periods in or out of crisis.

10. Conclusion

Our results provide us with evidence of a negative relationship between ETF ownership and stock volatility. The statistical significance of this finding depend heavily on model specification. However, this finding contradicts previous U.S. research, which indicates that the European ETF markets works differently. Further research is required in order to fully understand how the European ETF market works and its relationship with stock volatility.

It can be concluded that the size of a company is very important when discussing stock volatility. It is intuitive that companies with higher market capitalization have lower volatility, which is in line with the results of our logged market capitalization. The significance of ETF ownership for big companies in combination with a stronger relationship with volatility provides us with significant arguments for Hypothesis II.

As discussed in the analysis section, when the dummy variable "crisis" is used, we find significance for ETF ownership in both periods in and out of crisis. However, when conducting regressions with split samples and no interaction variables, ETF ownership is only significant for periods out of crisis. This suggests that there is a difference in the relationship between ETF ownership and stock volatility when the market is experiencing turbulence.

Our results are different than what precedent research have found, it can mainly be explained by the differences in markets (Europe vs U.S.), the difference in the amount of money invested in the ETF market in Europe and in the U.S. and also that our sample is imperfect. The results might be different due to us not being able to investigate the index-switching event that Chang et al. (2015) and Ben-David et al. (2017a) used in their theses. For further future research, an index-switching instrumental variable should be included to see if the effects of it is similar in Europe. We believe that a stock being included in a larger index has an effect on the volume of trading and the amount of media coverage it gets. Unfortunately, due to limited time we could not include such an IV in our regressions.

We are interested in seeing whether or not ETFs helps with price discovery at a stock level. There are some precedent research regarding this issue, however, we have not found anything on the european market. Are ETFs more than just an investment? Is it possible that ETFs can

be beneficial for investors, informed as uninformed? Do ETFs increase the markets efficiency in terms of accommodating the information faster and/or better and therefore price the assets more efficiently? Since this is outside the scope of this thesis we will leave this for further research.

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12. Appendix A

DATA APPENDIX

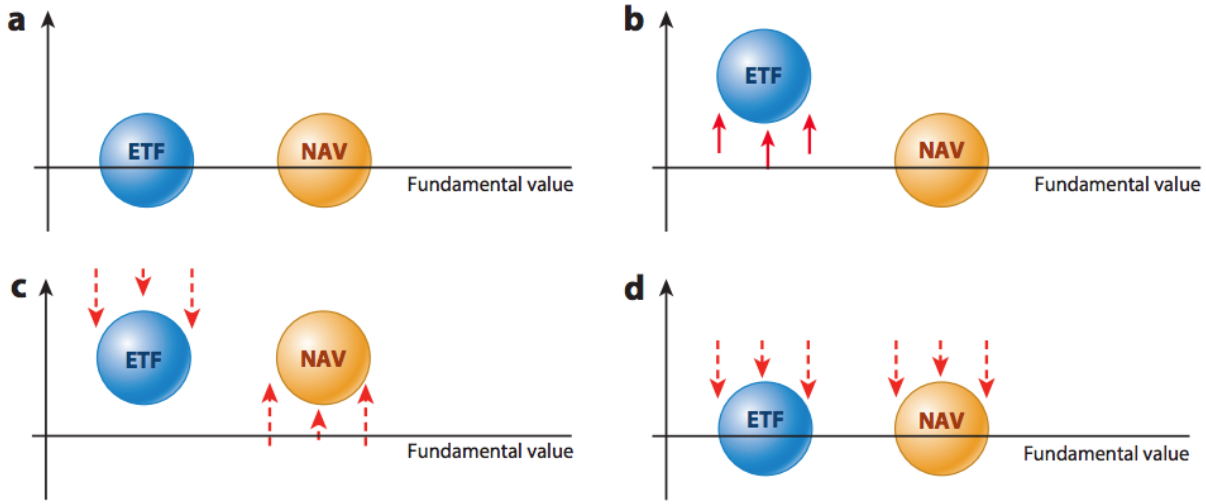
When retrieving the data, we could only look at 40 time periods at a time, hence the collection part exceeded the expected time. The final list contains 64 different ETFs and 1206 underlying stocks. The names are matched to the names of stocks in 26 large indices in the European zone. The largest indices in Austria, United Kingdom, Germany, France, Spain, Switzerland, Italy, Portugal, Ireland, Iceland, Netherlands, Belgium, Denmark, Finland, Norway, Sweden, Greece, Poland, Russia and Hungary[11] are used. We found the tickers using the VLOOKUP function in Excel, matching the names of the firm to their ticker names found in the large indices, in order to collect the daily data for each stock directly from Bloomberg. The values were originally reported in local currencies, thus not comparable. This is solved by using the same currency and since we are looking at Europe, the obvious choice of currency is the Euro. Python is used to merge the different excel files together and restructure

[11] ASX, NMX, UKX, DAX, PXAP, PAX, SBF 250, MADX, SMI, SPI, ITLMS, BVLX, ISEQ, ICEXI, AEX, BELSTK, OMXC25, HEXP, OSEAX, OMX, WBI, SAX, ASE, WIG, IMOEX, BUX

in order to make the data more manageable. In addition python is used to calculate and conduct the different control variables needed for our regressions that we were not able to download from Bloomberg. We use Python to calculate the lagged volatilities, formula 2 is used to get the returns, formula 3 is used to get the monthly volatility. We use monthly data on most variables, thus the monthly volatility is calculated. Python is used to lag all variables in order to replicate the regressions of Ben-David et al.

We collect the data using the Bloomberg spreadsheet function in excel, to gather information for market capitalization, volume, closing price, EBIT, bid and ask spread and total assets. We use the closing price to calculate the daily returns using formula (2), then by using Python the volatility is calculated using formula (3). The other variables are used to calculate our control variables in the regressions. Market capitalization is used as a benchmark for our dummy variables implemented in hypothesis II, where companies with a market capitalization less than €3.6 billion =0 and above the threshold =1. For hypothesis III we perform the same regressions as for hypothesis I and II but divide our sample into two parts. We divide our sample in time where one part only contains data from the period within crisis, and the other part contains the periods out of crisis. Dummy variables based on in (=1) or out of crisis (=0) are implemented for both parts and the full sample in order to have the possibility of comparison between the regressions.

Figure A.1



Source: Itzhak Ben-David, Francesco Franzoni, Rabih Moussawi. 2017b, Exchange Traded Funds, NBER Working Paper Series 22829.

Figure A.2

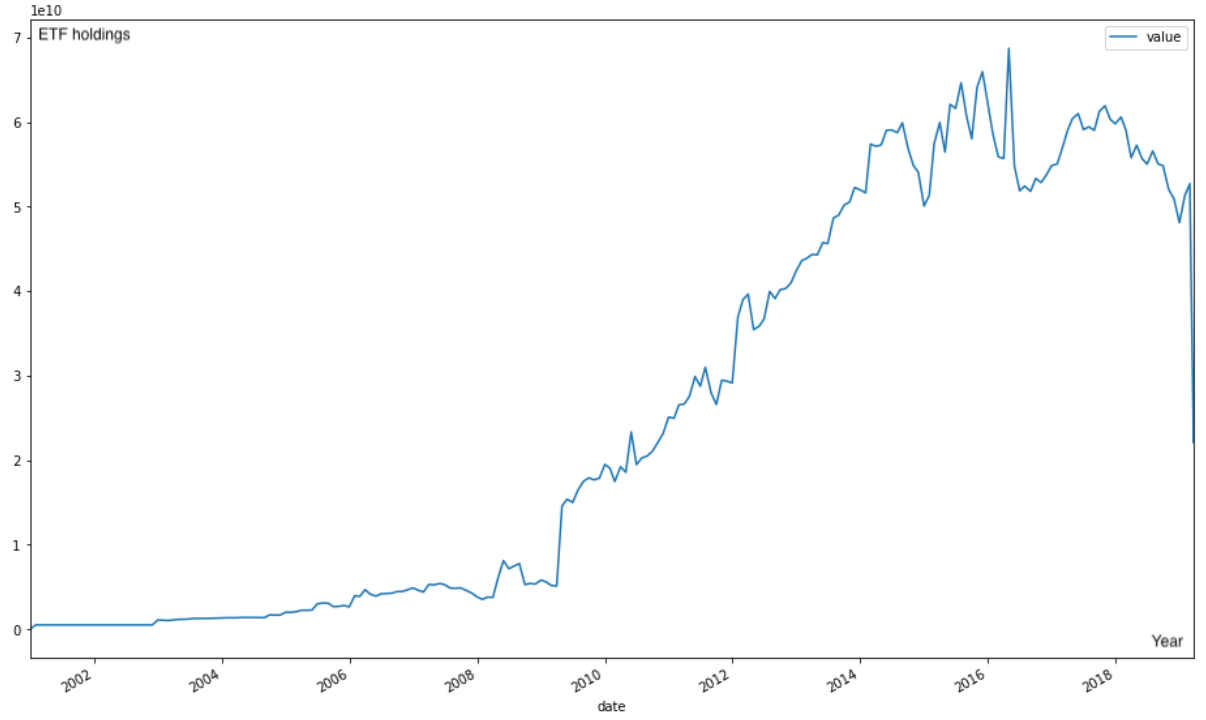


Figure A.3

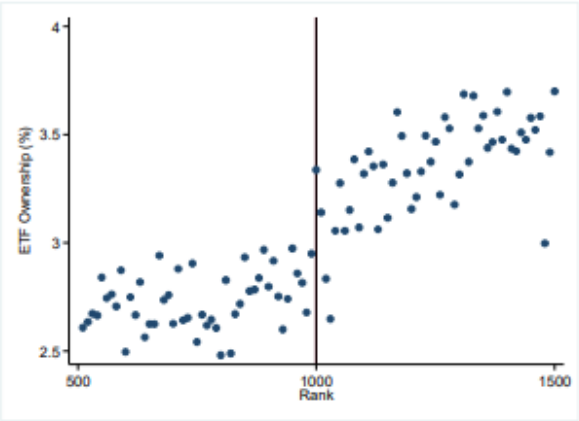


Figure 3a. ETF Ownership

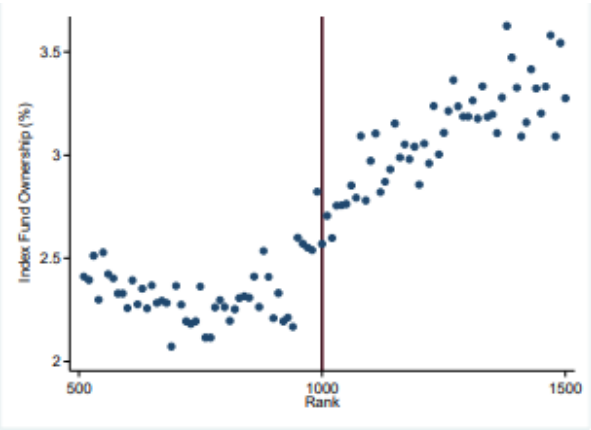
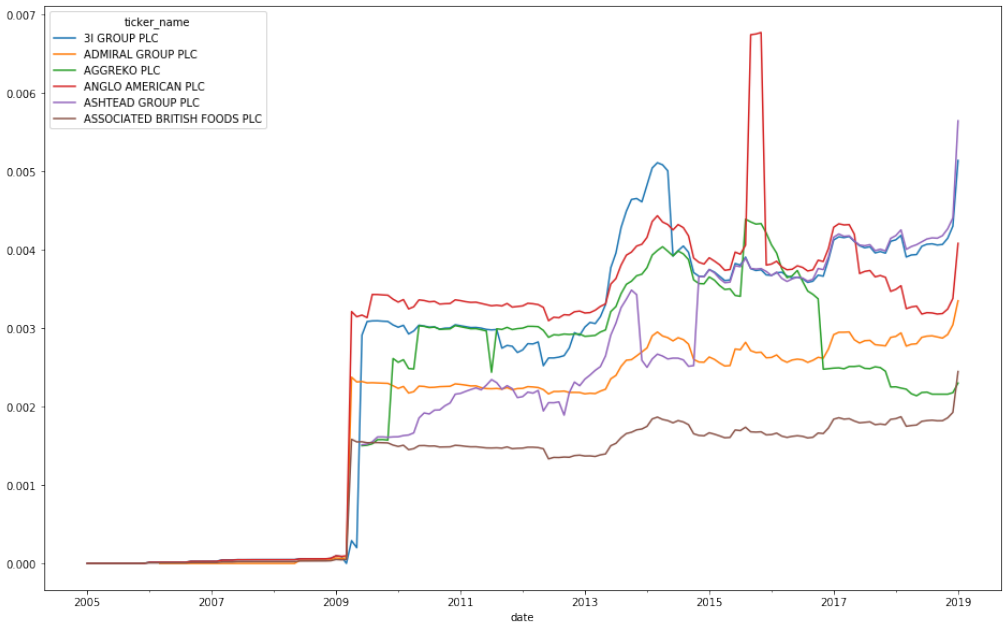


Figure 3b. Index-Fund Ownership

Source: Itzhak Ben-David, Francesco Franzoni and Rabih Moussawi, 2017a, Do ETFs increase volatility?, Dice Center WP 2011-20, Fisher College of Business WP 2011-03-20.

Figure A.4



13. Appendix B

Table B.1 - ETF ownership in Crisis

*The table shows estimates from ordinary least squares (OLS) regressions of monthly standardized volatility on ETF ownership and controls. T-statistics are presented in parentheses. ***, ** and * represent statistical significance at the 1%, 5%, and 10% levels respectively. The variables are lagged tm1 (t-1), (t-2) and (t-3). The sample only includes periods in crisis and ranges between 2008-09-30- to 2009-03-31, and 2009-10-01 to 2014-03-31.*

Dependent Variable	Standardized Volatility							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
standardized etf share owned	-0.0219	-0.0206	-0.0213	-0.0187	-0.0003	-0.0038	-0.0009	-0.0038
	(-1.36)	(-1.37)	(-1.38)	(-1.35)	(-0.03)	(-0.13)	(-0.08)	(-0.13)
log mkt cap tm1	-0.0510	-0.0738	-0.0504	-0.0705	-0.3340	-0.2524	-0.3383	-0.2509
	(-6.94)	(-5.42)	(-7.05)	(-6.49)	(-6.57)	(-2.84)	(-6.17)	(-2.90)
	***	***	***	***	***	***	***	***
inv price tm1	0.3082	0.4593	0.2784	0.4303	0.2474	0.2636	0.2338	0.2700
	(6.71)	(2.38)	(5.63)	(2.42)	(6.02)	(0.80)	(5.44)	(0.83)
	***	**	***	**	***		***	
amihud tm1	1182.7930	-589.0032	1015.2660	-533.9777	240.3822	-221.0149	165.0464	-221.5511
	(0.62)	(-1.60)	(0.57)	(-1.51)	(0.30)	(-1.24)	(0.21)	(-1.25)
abs returns tm1	0.0005	0.0009	0.0005	0.0008	0.0003	0.0003	0.0003	0.0003
	(3.87)	(3.65)	(3.93)	(3.87)	(1.71)	(1.93)	(1.73)	(1.92)
	***	***	***	***	*	*	*	*
bid ask spread tm1		-0.0003		-0.0002		-0.0003		-0.0003
		(-0.29)		(-0.18)		(-0.27)		(-0.26)
gross profitability tm1		-0.1033		-0.0643		0.4168		0.4133
		(-0.40)		(-0.26)		(1.49)		(1.49)
standardized volatility tm1			0.1962	0.2473			0.1318	0.0250
			(6.01)	(1.87)			(6.28)	(0.52)
			***	*			***	
standardized volatility tm2			0.0654	0.2242			0.0036	0.0133
			(1.61)	(1.81)			(0.17)	(0.28)
				*				
standardized volatility tm3			0.0560	0.2810			-0.0069	-0.0172
			(1.56)	(1.65)			(-0.35)	(-0.29)
cons	0.2660	0.3860	0.2686	0.3780	2.5637	1.8161	2.6024	1.8057
	(4.02)	(3.13)	(4.19)	(3.63)	(6.26)	(2.54)	(5.89)	(2.58)
	***	***	***	***	***	**	***	**
Time-fixed effects	False	False	False	False	True	True	True	True
Firm-fixed effects	False	False	False	False	True	True	True	True
N	30476	10760	30407	10751	30422	10688	30352	10679
Adjusted R^2	0.0847	0.0434	0.1039	0.0736	0.2821	0.332	0.2901	0.332
Firm-fixed effects	False	False	False	False	True	True	True	True
N	75523	45212	75319	45143	75523	45184	75317	45113
Adjusted R^2	0.0243	0.0321	0.0328	0.0352	0.1946	0.1958	0.1962	0.1958

Table B.2. ETF ownership Big in Crisis

*The table shows estimates from ordinary least squares (OLS) regressions of monthly standardized volatility on ETF ownership with "big" as an interaction variable, and controls. T-statistics are presented in parentheses. ***, ** and * represent statistical significance at the 1%, 5%, and 10% levels respectively. The variables are lagged tm1 (t-1), (t-2) and (t-3). The sample only includes periods in crisis and ranges between 2008-09-30- to 2009-03-31, and 2009-10-01 to 2014-03-31.*

Dependent Variable	Standardized Volatility							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
big# ETF Ownership 0	-0.0100	-0.0120	-0.0099	-0.0122	0.0054	0.0157	0.0046	0.0157
	(-0.51)	(-0.31)	(-0.53)	(-0.36)	(0.48)	(0.36)	(0.41)	(0.36)
big# ETF Ownership 1	-0.0411	-0.0249	-0.0398	-0.0220	-0.0212	-0.0379	-0.0208	-0.0377
	(-2.84)	(-2.34)	(-2.92)	(-2.09)	(-1.43)	(-2.15)	(-1.42)	(-2.03)
	***	**	***	**		**		*
log mkt cap tm1	-0.0514	-0.0736	-0.0508	-0.0704	-0.3338	-0.2536	-0.3382	-0.2522
	(-7.02)	(-5.43)	(-7.13)	(-6.51)	(-6.58)	(-2.86)	(-6.18)	(-2.91)
	***	***	***	***	***	***	***	***
inv price tm1	0.3083	0.4629	0.2785	0.4331	0.2476	0.2657	0.2340	0.2720
	(6.71)	(2.38)	(5.64)	(2.42)	(6.03)	(0.81)	(5.44)	(0.83)
	***	**	***	**	***		***	
amihud tm1	1189.8790	-584.1764	1022.2470	-530.3679	242.4086	-217.2046	167.0811	-217.7490
	(0.63)	(-1.57)	(0.58)	(-1.49)	(0.30)	(-1.23)	(0.21)	(-1.24)
abs returns tm1	0.0005	0.0009	0.0005	0.0008	0.0003	0.0003	0.0003	0.0003
	(3.79)	(3.66)	(3.84)	(3.87)	(1.71)	(1.93)	(1.74)	(1.92)
	***	***	***	***	*	*	*	*
bid ask spread tm1		-0.0004		-0.0002		-0.0003		-0.0003
		(-0.30)		(-0.19)		(-0.27)		(-0.25)
gross profitability tm1		-0.1045		-0.0653		0.4252		0.4218
		(-0.41)		(-0.26)		(1.51)		(1.51)
standardized volatility tm1			0.1960	0.2471			0.1317	0.0246
			(6.02)	(1.87)			(6.28)	(0.52)
			***	*			***	
standardized volatility tm2			0.0653	0.2241			0.0036	0.0131
			(1.61)	(1.81)			(0.17)	(0.27)
				*				
standardized volatility tm3			0.0560	0.2808			-0.0069	-0.0175
			(1.57)	(1.65)			(-0.35)	(-0.30)
cons	0.2687	0.3846	0.2712	0.3770	2.5618	1.8266	2.6005	1.8163
	(4.07)	(3.13)	(4.24)	(3.63)	(6.27)	(2.55)	(5.89)	(2.60)
	***	***	***	***	***	**	***	**
Time-fixed effects	False	False	False	False	True	True	True	True
Firm-fixed effects	False	False	False	False	True	True	True	True
N	30476	10760	30407	10751	30422	10688	30352	10679
Adjusted R^2	0.085	0.0434	0.1042	0.0735	0.2822	0.3322	0.2902	0.3322

Table B.3

*The table shows estimates from ordinary least squares (OLS) regressions of monthly standardized volatility on ETF ownership with "big" as an interaction variable and controls. T-statistics are presented in parentheses. ***, ** and * represent statistical significance at the 1%, 5%, and 10% levels respectively. The variables are lagged tm1 (t-1), (t-2) and (t-3). The sample only includes periods out of crisis and ranges between 2009-04-01 to 2009-09-30, and 2014-04-01 to 2019-01-31.*

Dependent Variable	Standardized Volatility							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
standardized etf share owned	-0.0349	-0.0384	-0.0345	-0.0378	-0.0034	0.0043	-0.0037	0.0041
	(-3.28)	(-5.24)	(-3.32)	(-5.24)	(-0.18)	(0.84)	(-0.20)	(0.80)
	***	***	***	***				
log mkt cap tm1	-0.0612	-0.0528	-0.0605	-0.0523	-0.1825	-0.1262	-0.1824	-0.1269
	(-8.17)	(-6.99)	(-8.27)	(-7.00)	(-4.81)	(-2.81)	(-4.78)	(-2.83)
	***	***	***	***	***	***	***	***
inv price tm1	0.0193	0.3439	0.0191	0.3391	0.0870	1.1023	0.0871	1.0990
	(1.00)	(1.33)	(1.00)	(1.32)	(1.08)	(2.95)	(1.08)	(2.96)
						***		***
amihud tm1	-104.0971	-132.1461	-107.4929	-132.6251	-157.1114	-49.4871	-156.8734	-49.7849
	(-0.84)	(-1.22)	(-0.90)	(-1.24)	(-1.40)	(-0.63)	(-1.40)	(-0.63)
abs returns tm1	0.0002	0.0003	0.0002	0.0002	0.0000	-0.0000	0.0000	-0.0000
	(2.54)	(1.62)	(2.50)	(1.45)	(0.96)	(-0.30)	(0.96)	(-0.21)
	**		**					
bid ask spread tm1		0.0040		0.0040		0.0017		0.0016
		(1.51)		(1.59)		(0.45)		(0.44)
gross profitability tm1		-0.2516		-0.2559		0.1605		0.1668
		(-0.95)		(-0.99)		(0.58)		(0.60)
standardized volatility tm1			0.0345	0.0289			0.0017	-0.0067
			(3.31)	(2.13)			(0.32)	(-1.53)
			***	**				
standardized volatility tm2			0.0402	0.0310			0.0079	-0.0044
			(4.63)	(3.26)			(1.00)	(-0.57)
			***	***				
standardized volatility tm3			0.0306	0.0235			-0.0003	-0.0107
			(3.85)	(2.50)			(-0.05)	(-1.69)
			***	**				*
cons	0.4573	0.3496	0.4533	0.3473	1.4658	0.9110	1.4649	0.9175
	(6.21)	(4.82)	(6.28)	(4.85)	(4.57)	(2.50)	(4.54)	(2.52)
	***	***	***	***	***	**	***	**
Time-fixed effects	False	False	False	False	True	True	True	True
Firm-fixed effects	False	False	False	False	True	True	True	True
N	45047	34452	44912	34392	45047	34452	44910	34390
Adjusted R^2	0.0209	0.03	0.025	0.0319	0.1815	0.1959	0.1815	0.196
Firm-fixed effects	False	False	False	False	True	True	True	True
N	75523	45212	75319	45143	75523	45184	75317	45113
Adjusted R^2	0.0243	0.0321	0.0328	0.0352	0.1946	0.1958	0.1962	0.1958

Table B.4

*The table shows estimates from ordinary least squares (OLS) regressions of monthly standardized volatility on ETF ownership with "big" as an interaction variable and controls. T-statistics are presented in parentheses. ***, ** and * represent statistical significance at the 1%, 5%, and 10% levels respectively. The variables are lagged tm1 (t-1), (t-2) and (t-3). The sample only includes periods out of crisis and ranges between 2009-04-01 to 2009-09-30, and 2014-04-01 to 2019-01-31.*

Dependent Variable	Standardized Volatility							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
big# ETF Ownership 0	-0.0282	-0.0374	-0.0282	-0.0370	-0.0014	0.0083	-0.0017	0.0082
	(-1.81)	(-3.74)	(-1.85)	(-3.75)	(-0.07)	(1.25)	(-0.08)	(1.24)
	*	***	*	***				
big# ETF Ownership 1	-0.0448	-0.0396	-0.0439	-0.0389	-0.0112	-0.0121	-0.0118	-0.0126
	(-4.36)	(-4.29)	(-4.37)	(-4.29)	(-0.63)	(-0.91)	(-0.66)	(-0.93)
	***	***	***	***				
log mkt cap tm1	-0.0614	-0.0529	-0.0606	-0.0523	-0.1825	-0.1262	-0.1824	-0.1269
	(-8.20)	(-7.00)	(-8.30)	(-7.01)	(-4.81)	(-2.81)	(-4.79)	(-2.83)
	***	***	***	***	***	***	***	***
inv price tm1	0.0193	0.3441	0.0191	0.3393	0.0870	1.1031	0.0871	1.0997
	(1.00)	(1.33)	(1.00)	(1.32)	(1.08)	(2.95)	(1.08)	(2.96)
						***		***
amihud tm1	-103.8358	-131.8501	-107.2350	-132.3686	-158.1258	-51.3260	-157.9194	-51.6519
	(-0.85)	(-1.22)	(-0.90)	(-1.23)	(-1.41)	(-0.66)	(-1.41)	(-0.66)
abs returns tm1	0.0002	0.0003	0.0002	0.0002	0.0000	-0.0000	0.0000	-0.0000
	(2.54)	(1.62)	(2.49)	(1.45)	(0.96)	(-0.30)	(0.96)	(-0.21)
	**		**					
bid ask spread tm1		0.0039		0.0040		0.0017		0.0017
		(1.51)		(1.59)		(0.46)		(0.44)
gross profitability tm1		-0.2519		-0.2561		0.1609		0.1672
		(-0.95)		(-0.99)		(0.59)		(0.60)
standardized volatility tm1			0.0345	0.0289			0.0017	-0.0068
			(3.31)	(2.13)			(0.32)	(-1.54)
			***	**				
standardized volatility tm2			0.0402	0.0310			0.0079	-0.0044
			(4.64)	(3.26)			(1.00)	(-0.57)
			***	***				
standardized volatility tm3			0.0305	0.0235			-0.0003	-0.0107
			(3.86)	(2.50)			(-0.05)	(-1.69)
			***	**				*
cons	0.4586	0.3497	0.4545	0.3473	1.4659	0.9112	1.4651	0.9177
	(6.22)	(4.83)	(6.29)	(4.85)	(4.57)	(2.50)	(4.54)	(2.53)
	***	***	***	***	***	**	***	**
Time-fixed effects	False	False	False	False	True	True	True	True
Firm-fixed effects	False	False	False	False	True	True	True	True
N	45047	34452	44912	34392	45047	34452	44910	34390
Adjusted R^2	0.021	0.03	0.0251	0.0319	0.1815	0.196	0.1815	0.1961

Table B.5

*The table shows estimates from ordinary least squares (OLS) regressions of monthly standardized volatility on ETF ownership and controls. T-statistics are presented in parentheses. ***, ** and * represent statistical significance at the 1%, 5%, and 10% levels respectively. The variables are lagged tm1 (t-1), (t-2) and (t-3). The sample ranges between 2009- to 2019-01-01*

Dependent Variable	Standardized Volatility															
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
standardized_etf_share_owned	-0.0320	-0.0340	-0.0315	-0.0334	-0.0286	-0.0344	-0.0281	-0.0338	-0.0037	0.0041	-0.0038	0.0041	0.0039	0.0056	0.0037	0.0055
	(-3.02)	(-4.41)	(-3.04)	(-4.39)	(-2.84)	(-4.48)	(-2.86)	(-4.47)	(-0.31)	(0.46)	(-0.33)	(0.45)	(0.37)	(0.65)	(0.36)	(0.63)
	***	***	***	***	***	***	***	***								
log_mkt_cap_tm1	-0.0617	-0.0593	-0.0607	-0.0586	-0.0559	-0.0555	-0.0550	-0.0548	-0.2607	-0.1788	-0.2589	-0.1789	-0.2029	-0.1415	-0.2014	-0.1416
	(-9.43)	(-8.07)	(-9.61)	(-8.10)	(-8.50)	(-7.76)	(-8.66)	(-7.78)	(-9.00)	(-4.96)	(-8.94)	(-4.95)	(-6.84)	(-3.59)	(-6.76)	(-3.58)
	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
inv_price_tm1	0.0294	0.3561	0.0286	0.3496	0.0301	0.3515	0.0294	0.3452	0.0953	1.0859	0.0952	1.0863	0.1002	1.0680	0.1001	1.0686
	(1.06)	(1.44)	(1.06)	(1.43)	(1.09)	(1.44)	(1.09)	(1.44)	(1.39)	(3.22)	(1.38)	(3.22)	(1.46)	(3.20)	(1.45)	(3.20)
										***		***		***		***
amihud_tm1	1040.6480	-169.9727	970.3847	-170.2014	996.8305	-219.7706	930.7637	-219.4524	418.3358	-37.7240	403.1139	-38.3974	358.7243	-97.9647	345.1266	-98.8869
	(0.98)	(-1.52)	(0.98)	(-1.54)	(0.95)	(-2.23)	(0.94)	(-2.26)	(0.83)	(-0.41)	(0.84)	(-0.42)	(0.70)	(-1.21)	(0.70)	(-1.23)
						**		**								
abs_returns_tm1	0.0003	0.0005	0.0003	0.0005	0.0003	0.0004	0.0002	0.0004	0.0002	0.0002	0.0002	0.0002	0.0001	0.0002	0.0001	0.0002
	(2.77)	(2.94)	(2.69)	(2.77)	(2.89)	(2.82)	(2.80)	(2.65)	(2.77)	(1.60)	(2.60)	(1.56)	(2.33)	(1.35)	(2.08)	(1.31)
	***	***	***	***	***	***	***	***	***		**		**		**	
bid_ask_spread_tm1		0.0022		0.0023		0.0026		0.0027		-0.0015		-0.0015		-0.0010		-0.0010
		(1.21)		(1.30)		(1.44)		(1.54)		(-0.62)		(-0.61)		(-0.45)		(-0.43)
gross_profitability_tm1		-0.2353		-0.2399		-0.2727		-0.2771		0.3891		0.3867		0.2684		0.2656
		(-1.12)		(-1.19)		(-1.24)		(-1.31)		(1.68)		(1.67)		(1.11)		(1.10)
										*		*				
standardized_volatility_tm1			0.0728	0.0404			0.0691	0.0395			0.0413	0.0057			0.0383	0.0054
			(2.69)	(2.00)			(2.63)	(2.12)			(1.80)	(0.62)			(1.70)	(0.66)
			***	**			***	**			*				*	
standardized_volatility_tm2			0.0548	0.0423			0.0525	0.0433			0.0225	0.0063			0.0211	0.0078
			(4.19)	(2.62)			(4.25)	(2.73)			(2.98)	(0.89)			(3.06)	(1.11)
			***	***			***	***			***				***	
standardized_volatility_tm3			0.0432	0.0331			0.0422	0.0345			0.0107	-0.0025			0.0107	-0.0008
			(3.44)	(2.18)			(3.54)	(2.28)			(1.65)	(-0.45)			(1.72)	(-0.14)
			***	**			***	**							*	
_cons	0.4175	0.3396	0.4120	0.3367	0.3694	0.3100	0.3648	0.3073	2.0565	1.2745	2.0430	1.2755	1.5784	0.9722	1.5663	0.9731
	(6.84)	(4.93)	(6.97)	(4.98)	(6.43)	(4.95)	(6.58)	(5.02)	(8.44)	(4.33)	(8.39)	(4.33)	(6.37)	(3.05)	(6.30)	(3.05)
	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
Time-fixed effects	False	False	False	False	True	True	True	True	False	False	False	False	True	True	True	True
Firm-fixed effects	False	False	False	False	False	False	False	False	True	True	True	True	True	True	True	True
N	75523	45212	75319	45143	75523	45184	75319	45115	75523	45212	75317	45141	75523	45184	75317	45113
R^2_{adj}	0.0241	0.0322	0.0326	0.0352	0.0777	0.0809	0.0854	0.0841	0.1488	0.1501	0.1506	0.1501	0.1945	0.1957	0.1962	0.1957

Table B.6

*The table shows estimates from ordinary least squares (OLS) regressions of monthly realized variance on ETF ownership and controls. T-statistics are presented in parentheses. ***, ** and * represent statistical significance at the 1%, 5%, and 10% levels respectively. The variables are lagged tm1 (t-1), (t-2) and (t-3). The sample ranges between 2008-09-30 to 2019-01-31.*

Dependent Variable	Realized Variance							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
standardized etf share owned	-.0040583 **	-.00289 *	-.0039384 **	-.0028271	-.0038537	-.0004054	-.003948	-.0004263
	(-2.05)	(-1.67)	(-2.06)	(-1.65)	(-0.90)	(-0.16)	(-0.91)	(-0.17)
log mkt cap tm1	-.0093252 ***	-.0060394	-.0090656 ***	-.0059447	-.0414641	-.0322363	-.0419284	-.0333432
	(-2.89)	(-1.52)	(-2.87)	(-1.51)	(-1.23)	(-0.86)	(-1.24)	(-0.89)
inv price tm1	.0232041	.2371604	.0230058	.2364468	.1145377	1.007896 **	.1145117	1.005811 **
	(0.89)	(1.29)	(0.89)	(1.29)	(1.17)	(2.50)	(1.17)	(2.51)
amihud tm1	327.6978	39.22962	309.6154	39.48843	-89.25454	-36.25732	-90.47273	-35.9871
	(0.98)	(-1.55)	(0.98)	(-1.56)	(-0.31)	(-1.18)	(-0.31)	(-1.16)
abs returns tm1	.0000207 *	-.0000586	.0000162	-.0000627	.0000163	-.0000115	.0000149	-2.15e-06
	(1.98)	(-0.67)	(1.55)	(-0.72)	(1.02)	(-0.35)	(0.95)	(-0.07)
bid ask spread tm1		.0015541		.0015674		.0021935		.002064
		(0.93)		(0.94)		(0.86)		(0.84)
gross profitability tm1		.1278022		.1275947		.2581896		.2682295
		(1.40)		(1.41)		(1.45)		(1.46)
standardized volatility tm1			.0226781 **	.0064703 **			.0056464	-.0116917 **
			(2.06)	(2.12)			(0.63)	(-2.00)
standardized volatility tm2			.010752 ***	.0044439 *			-.0059442 *	-.012955 **
			(3.09)	(1.88)			(-1.82)	(-2.52)
standardized volatility tm3			.0074276 ***	.0026456			-.0301341 ***	-.0485082 ***
			(2.66)	(1.36)			(-2.93)	(-2.93)
cons	.0575114 **	.0084793	.0561148 *	.0080864	.3126146	.1812246	.3169881	.1902952
	(1.99)	(0.27)	(1.98)	(0.26)	(1.10)	(0.63)	(1.11)	(0.66)
Time-Fixed Effects	No	No	No	No	Yes	Yes	Yes	Yes
Firm-Fixed Effects	No	No	No	No	Yes	Yes	Yes	Yes
N	75523	45212	75319	45143	75523	45184	75317	45113
Adjusted R^2	0.0056	0.0063	0.0062	0.0063	0.0296	0.0228	0.0298	0.0233

Table B.7

*The table shows estimates from ordinary least squares (OLS) regressions of monthly realized variance on ETF ownership with "big" and "crisis" as interaction variables, and controls. T-statistics are presented in parentheses. ***, ** and * represent statistical significance at the 1%, 5%, and 10% levels respectively. The variables are lagged tm1 (t-1), (t-2) and (t-3). The sample ranges between 2008-09-30 to 2019-01-31.*

Dependent Variable	Realized Variance							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
crisis#big# ETF Ownership 0 0	-.0017792	-.0021592	-.0017766	-.0021001	-.0018002	.000933	-.0018789	.000919
	(-0.38)	(-0.73)	(-0.39)	(-0.72)	(-0.27)	(0.30)	(-0.28)	(0.29)
crisis#big# ETF Ownership 0 1	-.0070763 **	-.0059512 **	-.006781 **	-.0058522 **	-.0084333	-.0086181	-.0085679	-.0087937
	(-2.15)	(-2.01)	(-2.11)	(-1.99)	(-1.36)	(-1.56)	(-1.36)	(-1.56)
crisis#big# ETF Ownership 1 0	-.002513	0.0044833	-.0024402	.0044758	-.0025794	.0087449	-.0026503	.0089781
	(-0.91)	(0.56)	(-0.92)	(0.56)	(-0.62)	(1.02)	(-0.63)	(1.02)
crisis#big# ETF Ownership 1 1	-.0070782 **	-.0027815	-.0068829 **	-.0027406	-.0109459 **	-.0053577	-.011136 *	-.0054728
	(-2.29)	(-1.24)	(-2.38)	(-1.23)	(-2.02)	(-1.57)	(-1.88)	(-1.57)
log mkt cap tm1	-.0093782 ***	-.0060334	-.0091158 ***	-.0059383	-.0416122	-.0319896	-.0420765	-.0330928
	(-2.92)	(-1.52)	(-2.89)	(-1.51)	(-1.23)	(-0.86)	(-1.24)	(-0.89)
inv price tm1	.0231938	.2375448	.0229962	.2368314	.1145458	1.008634 **	.1145199	1.006562 **
	(0.89)	(1.30)	(0.89)	(1.29)	(1.17)	(2.50)	(1.17)	(2.51)
amihud tm1	328.0636	-38.77818	309.9849	-39.03946	-89.66702	-37.24303	-90.88675	-36.99215
	(0.99)	(-1.51)	(0.98)	(-1.52)	(-0.31)	(-1.21)	(-0.31)	(-1.19)
abs returns tm1	.0000194 *	-.0000593	.000015	-.0000634	.0000165	-.0000113	.0000151	-1.84e-06
	(1.87)	(-0.69)	(1.43)	(-0.73)	(1.03)	(-0.34)	(0.96)	(-0.06)
bid ask spread tm1		.0015456		.0015589		.0022005		.0020709
		(0.92)		(0.93)		(0.87)		(0.85)
gross profitability tm1		.1272947		.1270944		.2616756		.2718075
		(1.40)		(1.41)		(1.46)		(1.47)
standardized volatility tm1			.0226682 **	.006457 **			.0056403	-.011713 **
			(2.06)	(2.12)			(0.58)	(-2.00)
standardized volatility tm2			.01074 ***	.004428 *			-.0059467 *	-.012972 **
			(3.07)	(1.88)			(-1.77)	(-2.52)
standardized volatility tm3			.0074179 **	.0026259			-.0301304 ***	-.0485826 ***
			(2.61)	(1.36)			(-2.93)	(-2.92)
cons	.0578972 **	.0084341	.0564782 **	.0080376	.3137275	.1791288	.3180993	.1881682
	(2.01)	(0.27)	(2.00)	(0.26)	(1.10)	(0.62)	(1.12)	(0.65)
Time-Fixed Effects	No	No	No	No	Yes	Yes	Yes	Yes
Firm-Fixed Effects	No	No	No	No	Yes	Yes	Yes	Yes
N	75523	45212	75319	45143	75523	45184	75317	45113
Adjusted R^2	0.0055	0.0062	0.0062	0.0062	0.0296	0.0228	0.0221	0.0233
cons	0.4193	0.3396	0.4137	0.3367	1.5803	0.9760	1.5682	0.9770
	(6.88)	(4.93)	(7.01)	(4.98)	(6.39)	(3.06)	(6.31)	(3.06)
	***	***	***	***	***	***	***	***
Time-fixed effects	False	False	False	False	True	True	True	True
Firm-fixed effects	False	False	False	False	True	True	True	True
N	75523	45212	75319	45143	75523	45184	75317	45113
Adjusted R^2	0.0243	0.0321	0.0328	0.0352	0.1946	0.1958	0.1962	0.1958

Table B.8

*The table shows estimates from ordinary least squares (OLS) regressions of monthly realized variance on ETF ownership with "big" as an interaction variable, and controls. T-statistics are presented in parentheses. ***, ** and * represent statistical significance at the 1%, 5%, and 10% levels respectively. The variables are lagged tm1 (t-1), (t-2) and (t-3). The sample only includes periods in crisis and ranges between 2008-09-30- to 2009-03-31, and 2009-10-01 to 2014-03-31.*

Dependent Variable	Realized Variance							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
big# ETF Ownership = 0	-.0006164	.0009393	-.0006157	.0009066	-.0002338	.0094212	-.0003451	.009773
	(-0.27)	(0.13)	(-0.29)	(0.14)	(-0.09)	(0.79)	(-0.13)	(0.76)
big# ETF Ownership = 1	-.0054699 **	-.0044173 **	-.005123	-.0040525 *	-.0106187	-.0020463	-.0106762	-.0024245
	(-2.56)	(-2.10)	(-1.50)	(-1.90)	(-1.52)	(-0.62)	(-1.25)	(-0.67)
log mkt cap tm1	-.0052769 ***	-.003609	-.0051655 **	-.0032196	-.0798532	-.028016	-.0811703	-.0336936
	(-2.78)	(-0.86)	(-2.68)	(-0.89)	(-1.67)	(-1.28)	(-1.67)	(-1.46)
inv price tm1	.1291968 ***	439507.00	.1221653 ***	.0402367	.1336058 **	-.0218681	.1354889 **	-.0267771
	(2.94)	(1.66)	(2.77)	(1.64)	(2.51)	(-0.22)	(2.54)	(-0.23)
amihud tm1	-109.4355	-84.43535 **	-164.3299	-77.91208 **	-419.3261	-10.42681	-447.9014	-8.737034
	(-0.11)	(-2.13)	(-0.17)	(-2.02)	(-0.47)	(-0.79)	(-0.50)	(-0.73)
abs returns tm1	.0000531 ***	.0000797 **	.0000509 **	.0000728 **	.0000487	7.84e-06	.0000473	6.23e-06
	(2.70)	(2.38)	(2.69)	(2.54)	(1.21)	(0.19)	(1.16)	(0.14)
bid ask spread tm1		-.0001752		-.0001568		.0003271		.0002478
		(-0.99)		(-0.91)		(0.45)		(0.43)
gross profitability tm1		-.0055566		-.0007056		.1044523 *		.1066834 *
		(-0.17)		(-0.02)		(1.81)		(1.76)
standardized volatility tm1			.0642888 ***	.0305909			.0294289 **	-.0352395 **
			(5.71)	(1.59)			(2.35)	(-2.31)
standardized volatility tm2			.0058774	.0299702			-.0282063 **	-.034281 *
			(0.68)	(1.56)			(-2.58)	(-1.82)
standardized volatility tm3			.004304	.0323636			-.1031716 ***	-.1495473 *
			(0.95)	(1.49)			(-3.62)	(-1.85)
cons	.0182031	.0030078	.0190223	.0020827	.6214592	.1967824	.6336557	.2429678
	(1.12)	(0.09)	(1.16)	(0.07)	(1.62)	(1.12)	(1.63)	(1.32)
Time-Fixed Effects	No	No	No	No	Yes	Yes	Yes	Yes
Firm-Fixed Effects	No	No	No	No	Yes	Yes	Yes	Yes
N	30476	10760	30407	10751	30422	10688	30352	10679.00
Adjusted R^2	0.0285	0.0006	0.0324	0.0030	0.0466	0.0222	0.0505	0.0254

Table B.9

*The table shows estimates from ordinary least squares (OLS) regressions of monthly realized variance on ETF ownership with "big" as an interaction variable, and controls. T-statistics are presented in parentheses. ***, ** and * represent statistical significance at the 1%, 5%, and 10% levels respectively. The variables are lagged tm1 (t-1), (t-2) and (t-3). The sample only includes periods out of crisis and ranges between 2009-04-01 to 2009-09-30, and 2014-04-01 to 2019-01-31.*

Dependent Variable	Realized Variance							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
big# ETF Ownership = 0	-.0019593	-.0015095	-.0019782	-.0014753	-.0087386	.0007543	-.0090257	.0008373
	(-0.41)	(-0.48)	(-0.42)	(-0.48)	(-0.67)	(0.24)	(-0.67)	(0.26)
big# ETF Ownership = 1	-.0078325 **	-.0052479	-.0076773 **	-.0051833	-.0074444	-.0122899	-.0075541	-.0125386
	(-2.29)	(-1.58)	(-2.26)	(-1.56)	(-1.22)	(-1.57)	(-1.20)	(-1.57)
log mkt cap tm1	-.0104743 **	-.0063534	-.0103252 **	-.0062761	-.0360532	-.0391651	-.0369774	-.0395732
	(-2.11)	(-1.33)	(-2.10)	(-1.32)	(-0.93)	(-0.86)	(-0.95)	(-0.88)
inv price tm1	.019307	.2596178	.019275	.2591406	.1204656	1.148267 **	.1200005	1.140391 **
	(0.80)	(1.23)	(0.80)	(1.23)	(0.99)	(2.61)	(0.99)	(2.62)
amihud tm1	-46.49668	-39.05127	-47.4727	-39.39244	-154.9364	-42.31706	-158.1072	-41.78963
	(-1.44)	(-1.28)	(-1.48)	(-1.29)	(-1.04)	(-1.04)	(-1.04)	(-1.02)
abs returns tm1	9.95e-06	-.0001533	7.66e-06	-.0001583	-8.86e-06	-.0000584	-4.91e-06	-.0000396
	(1.05)	(-1.08)	(0.80)	(-1.12)	(-0.58)	(-1.33)	(-0.38)	(-1.07)
bid ask spread tm1		.002746		.0027631		.0052518		.0050879
		(0.97)		(0.98)		(0.98)		(0.97)
gross profitability tm1		.1597449		.1597869		.2706241		.286446
		(1.41)		(1.42)		(1.24)		(1.26)
standardized volatility tm1			.0088901 **	.0053193 *			-.0102256 **	-.016555 **
			(2.10)	(1.97)			(-2.41)	(-2.11)
standardized volatility tm2			.0073665 **	.0027198			-.0113874 **	-.0180752 **
			(2.47)	(1.51)			(-2.19)	(-2.60)
standardized volatility tm3			.0045205 **	.001325			-.0463104 ***	-.0631108 ***
			(2.65)	(0.87)			(-3.35)	(-2.89)
cons	.0675826	.0080313	.0667384	.0076675	.2668616	.2273905	.2751111	.2307385
	(1.50)	(0.21)	(1.50)	(0.20)	(0.80)	(0.64)	(0.83)	(0.66)
Time-Fixed Effects	No	No	No	No	Yes	Yes	Yes	Yes
Firm-Fixed Effects	No	No	No	No	Yes	Yes	Yes	Yes
N	45047	34452	44912	34392	45047	34452	44910	34390
Adjusted R^2	0.0046	0.0073	0.0047	0.0072	0.0278	0.0255	0.0281	0.0263

Summarized statistics

Full sample

Variable	Obs	Mean	Std. Dev.	Min	Max
Standardized Volatility	122269	0.0000	1	-0.9762	67.5074
ETF Ownership	78355	0.0032	0.0061	0.0000	0.2780
Log Market Cap	121315	7.6917	1.9581	0.1027	14.5882
Inverted Price	121122	0.1939	2.5448	0.0000	172.4138
Amihud	115510	0.0000	0.0002	0.0000	0.0413
bid-ask-spread	78746	2.1444	17.9446	0.0005	4081.7160
Gross Profitability	100482	0.0332	0.1367	-3.1544	11.7750
Absolute Returns	121111	10.1667	78.0623	0.0000	11532

In Crisis

Variable	Obs	Mean	Std. Dev.	Min	Max
Standardized Volatility	55179	0.0000	1	-1.1022	46.0080
ETF Ownership	32205	0.0029	0.0062	0.0000	0.2780
Log Market Cap	53966	7.4983	2.0118	0.1027	14.5882
Inverted Price	54215	0.1770	2.2374	0.0000	172.4138
Amihud	49912	0.0000	0.0003	0.0000	0.0413
bid-ask-spread	19703	2.2719	10.4495	0.0005	270.4029
Gross Profitability	43249	0.0351	0.0849	-2.4277	1.4089
Absolute Returns	54209	9.9594	69.6642	0.0000	4500

Out of Crisis

Variable	Obs	Mean	Std. Dev.	Min	Max
Standardized Volatility	67090	0.0000	1	-0.8845	66.1154
ETF Ownership	46150	0.0034	0.0061	0.0000	0.2268
Log Market Cap	67349	7.8468	1.8998	0.1027	14.4534
Inverted Price	66907	0.2076	2.7689	0.0000	140.8451
Amihud	65598	0.0000	0.0002	0.0000	0.0255
bid-ask-spread	59043	2.1019	19.8248	0.0006	4081.7160
Gross Profitability	57233	0.0316	0.1654	-3.1544	11.7750
Absolute Returns	66902	10.3346	84.2554	0.0000	11532

Correlation Tables

Full sample

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Standarized Volatility	(1)	1										
ETF Ownership	(2)	-0.0567	1									
log market capitalization	(3)	-0.131	0.001	1								
Inverse Price	(4)	0.1072	-0.0636	-0.0931	1							
Amihud	(5)	-0.0003	-0.0152	-0.0164	-0.0025	1						
Bid-Ask spread	(6)	0.031	-0.0777	0.0826	-0.0524	0.0184	1					
Gross Profitability	(7)	-0.0281	-0.0023	0.0446	-0.1217	-0.0029	0.15	1				
Absolute Returns	(8)	0.0297	-0.0447	0.1624	-0.0391	0.0014	0.5188	0.1843	1			
Standardized Volatility (t-1)	(9)	0.0399	-0.0108	-0.0181	0.0187	0.002	0.004	0.0059	0.0484	1		
Standardized Volatility (t-2)	(10)	0.0395	-0.0112	-0.0173	0.0195	-0.0007	0.0015	0.0049	0.0009	0.0082	1	
Standardized Volatility (t-3)	(11)	0.0317	-0.011	-0.0164	0.0189	-0.0008	0.0024	0.0062	0	0.0065	0.0082	1

In Crisis

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Standarized Volatility	(1)	1										
ETF Ownership	(2)	-0.0469	1									
log market capitalization	(3)	-0.1598	0.0184	1								
Inverse Price	(4)	0.0896	-0.0666	-0.0512	1							
Amihud	(5)	-0.0052	-0.0252	-0.0075	-0.0099	1						
Bid-Ask spread	(6)	0.0183	-0.0826	0.16	-0.0695	0.0401	1					
Gross Profitability	(7)	-0.0114	-0.0146	0.0533	-0.1051	-0.0043	0.163	1				
Absolute Returns	(8)	0.0671	-0.0563	0.1926	-0.0503	0.0026	0.5248	0.1553	1			
Standardized Volatility (t-1)	(9)	0.1175	-0.013	-0.0203	0.0214	-0.0016	-0.0028	-0.0132	0.0126	1		
Standardized Volatility (t-2)	(10)	0.1077	-0.0135	-0.0197	0.018	-0.0018	-0.0017	-0.0098	0.0134	0.0346	1	
Standardized Volatility (t-3)	(11)	0.1111	-0.0115	-0.0333	0.0225	-0.0028	-0.0006	-0.0169	0.0113	0.0422	0.0425	1

Out of Crisis

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Standarized Volatility	(1)	1										
ETF Ownership	(2)	-0.0609	1									
log market capitalization	(3)	-0.121	-0.0032	1								
Inverse Price	(4)	0.1121	-0.0647	-0.1048	1							
Amihud	(5)	0.0004	-0.0144	-0.0185	-0.0019	1						
Bid-Ask spread	(6)	0.0361	-0.0778	0.0517	-0.0521	0.0163	1					
Gross Profitability	(7)	-0.0323	0.0013	0.043	-0.1255	-0.0028	0.1517	1				
Absolute Returns	(8)	0.0154	-0.0402	0.1544	-0.0388	0.0014	0.5153	0.2009	1			
Standardized Volatility (t-1)	(9)	0.032	-0.0111	-0.0187	0.0185	0.0022	0.006	0.0083	0.0608	1		
Standardized Volatility (t-2)	(10)	0.0326	-0.0116	-0.0179	0.0197	-0.0006	0.0025	0.0068	-0.0012	0.0067	1	
Standardized Volatility (t-3)	(11)	0.0258	-0.0117	-0.0158	0.0189	-0.0007	0.0034	0.0086	-0.0016	0.0049	0.0066	1

Winsorizing tests

	5%					
z_squareroot_volatility	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
winsor_5standard_etf_share_owned	0.0132097	0.0237209	0.56	0.579	-0.0339703	0.0603897
log_mkt_cap_tm1	-0.1420843	0.0395186	-3.6	0.001	-0.2206852	-0.0634834
inv_price_tm1	1.068502	0.3343627	3.2	0.002	0.4034684	1.733537
amihud_tm1	-98.48389	81.18263	-1.21	0.229	-259.9529	62.98509
bid_ask_spread_tm1	-0.0009951	0.0023329	-0.43	0.671	-0.0056352	0.003645
gross_profitability_tm1	0.266581	0.2413006	1.1	0.272	-0.2133561	0.7465182
abs_returns_tm1	0.0001512	0.0001154	1.31	0.194	-0.0000783	0.0003806
standardized_volatility_tm1	0.0053805	0.0080956	0.66	0.508	-0.0107213	0.0214824
standardized_volatility_tm2	0.0077763	0.0069872	1.11	0.269	-0.006121	0.0216735
volatility_tm3	-0.00256	0.0184054	-0.14	0.89	-0.0391676	0.0340475
_cons	0.9778697	0.319752	3.06	0.003	0.3418957	1.613844
Time fixed effects	Yes					
Firm fixed effects	Yes					

	1%					
z_squareroot_volatility	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
winsor_standard_etf_share_owned	0.0225587	0.0180545	1.25	0.215	-0.013351	0.0584684
log_mkt_cap_tm1	-0.1423204	0.0395214	-3.6	0.001	-0.2209268	-0.0637139
inv_price_tm1	1.068434	0.3343729	3.2	0.002	0.40338	1.733488
amihud_tm1	-97.17145	81.87592	-1.19	0.239	-260.0194	65.67646
bid_ask_spread_tm1	-0.0009918	0.0023319	-0.43	0.672	-0.0056299	0.0036463
gross_profitability_tm1	0.2696289	0.2431366	1.11	0.271	-0.21396	0.7532179
abs_returns_tm1	0.0001507	0.0001152	1.31	0.194	-0.0000783	0.0003798
standardized_volatility_tm1	0.0053658	0.0080792	0.66	0.508	-0.0107035	0.0214351
standardized_volatility_tm2	0.0077716	0.0069784	1.11	0.269	-0.0061082	0.0216515
volatility_tm3	-0.0025881	0.0183759	-0.14	0.888	-0.0391371	0.0339609
_cons	0.9785095	0.31965	3.06	0.003	0.3427385	1.614281
Time fixed effects	Yes					
Firm fixed effects	Yes					

List of ETFs in our sample

100CHA	*ETFDAX*	*LYXIB*
AETF	*ETFDAXK*	*MDAXEX*
ATXEX	*ETFMIB*	*MIDD*
BBVAI	*EWD*	*OBXEDNB*
C40	*EWG*	*PSRU*
CAC	*EWI*	*SLICHA*
CBATX	*EWK*	*SMICHA*
CBDAX	*EWL*	*SMIEX*
CF1	*EWN*	*SYGUK*
CG1	*EWO*	*TDXPEX*
CH1	*EWP*	*XACTOMX*
CI1	*EWQ*	*XACTSBX*
CO30	*EWU*	*XASX*
CS1	*GRE*	*XCAC*
CSSLI	*H25ETF*	*XDAX*
CSSMI	*IAEX*	*XMCX*
CSSMIM	*IMIB*	*XMIB*
CSSSMIM	*ISF*	*XSLI*
CSW	*IUKD*	*XSMI*
CU1	*IUKP*	*XUKX*
DAXEX	*L100*	
DDAXKEX	*LYXDAX*	