The effect of ETFs on financial markets

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ABSTRACT
Exchange-traded funds (ETFs) belong to the fastest growing investment products worldwide. Within 15 years, total assets invested in ETFs have twenty-folded, reaching over $3.7 trillion at the end of 2018. Increasing demand for passive investments, coupled with high liquidity and low transaction costs are key advantages of ETFs compared to their closest substitutes such as traditional index funds. Besides the continuous growth of ETFs, the Flash Crash in 2010 triggered detailed investigations by regulators on how ETFs affect the financial market. This literature review gives the reader a broad overview of recent academic studies analysing the effect of ETFs on liquidity, price discovery, volatility and comovement of the underlying securities.

Keywords: exchange-traded funds, liquidity, price discovery, volatility, comovement

JEL Classifications: G12, G13

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I. Introduction

On October 19th, 1987 - better known as Black Monday - the Dow Jones Industrial Average (DJIA) declined by more than 24% within a single day. It remarked the most significant stock market decline in the history of the DJIA within a single trading day (Bogle (2008)). In response to the stock market crash, the Security Exchange Commission (SEC) published a white paper analysing the causes of the collapse. The key finding of the report was that index futures and program trading caused the crash. When markets started to decline investors sold index futures, whereby S&P500 index futures fell by 29%. With index futures trading at a discount, program traders went long the index future and short the underlying stocks. This put additional downward pressure on individual stocks. The Black Monday illustrated how a shock in the future market can propagate to the stock market (Carlson (2007), Balchunas (2016)). The white paper published by the SEC in 1987 asked for a single product, enabling investors to trade a whole basket of securities on an exchange (US SEC (1987)).

The first product in the U.S. offering this unique feature was introduced by Standard & Poor’s Depositary Receipt (SPDR) on January 23rd, 1993. Named after the underlying index, the S&P500 SPDR is the worldwide largest exchange-traded fund (ETF) with over $260 billion in total assets (Hill (2016)). Despite being a young investment vehicle, ETFs are regarded as a key innovation of modern financial markets. Even among non-economists, ETFs are well-known for their diversification potential, low-cost structure and high liquidity. Similar to index mutual funds, ETFs enable investors to gain passive exposure to broad indices. However, unlike open-end (closed-end) funds, ETFs are traded continuously on an exchange (can create and redeem shares). Therefore, ETFs combine characteristics of open- and closed-end funds. Moreover, as ETFs must not keep track of individual shareholders, the average expense ratio for ETFs is 0.1%, compared to 0.3% for index funds. These additional features make ETFs attractive for small retail investors as well as large institutions, who want to gain exposure to a broad market (Gastineau (2001)). The superiority of ETFs is reflected in a continuously increasing market share, partly at the costs of index futures and index mutual funds (Agapova (2011)). Within the past 15 years, total assets of ETFs (index funds) have twenty-folded (seven-folded), whereas active mutual funds grew by only 130%. Today, over 6’400 ETFs are traded worldwide with total assets over $3 trillion (ICI (2019)). In the U.S., among the ten most frequently traded securities are seven ETFs (Daniel (2016)).
Fig. 1 depicts assets under management (AUM) of active funds, index funds and ETFs since 2003. First, AuM of ETFs have increased from $151 billion in 2013 to over $3.7 trillion at the end of 2018. Second, it is evident that assets migrate from active to passive investments. A potential reason for the observed shift from active into passive investing might be the finding that actively-managed mutual funds on average underperform after fees, relative to the index (Jensen (1968), Gruber (1996), Carhart (1997)).

Ironically, as the financial crisis in 1987 triggered the demand by SEC for a product such as ETFs, another crisis caused regulators to investigate ETFs in more detail. During the Flash Crash on May 6th, 2010, the DJIA dropped 9% within minutes. Surprisingly, equity-based ETFs were significantly affected by price dislocations and illiquidity as market makers paused their trading activity at 2:45 p.m. (CFTC (2010a), CFTC (2010b)). Since the Flash Crash in 2010, the number of economic papers investigating ETFs has quadrupled. The goal of this paper is to synthesize the academic literature on ETFs and their relation to component stocks. In a first step, I describe the structure of ETFs and the underlying arbitrage mechanism that is responsible for consistent prices between ETF shares and the underlying securities (sec. II). Second, I present and discuss the results of several academic studies analyzing the effect of ETFs on financial markets in a detailed literature review (sec. III). I group the literature according to their investigated effect (fig. 2).
This figure depicts the strands of academic literature grouped by their investigated effect. Most strands originate from the liquidity strand. Due to the late introduction of leveraged ETFs in 2006, this strand of literature is less developed.

Although some papers investigate multiple effects simultaneously, I will re-mention these papers in the corresponding section. As a starting point, I use the paper by Ben-David, Franzoni, and Moussawi (2018), which covers all main strands of the ETF literature (excl. comovement). Due to the recent publication and the author’s detailed and robust analysis, a larger portion is devoted to this paper. Furthermore, the introduction of leveraged ETFs in 2006 has established a very new field of academic research. Despite, few publications and comparably low assets invested in leveraged ETFs, further research in this field would complement the current literature. Finally, sec. IV concludes and provides ideas for further research.
II. Understanding ETFs

Dependant on the replication methodology, ETFs can either be classified as physical or synthetic. Physical ETFs hold the underlying securities (e.g. stocks or bonds) physically, whereas synthetic ETFs are using total return swaps to replicate the price of the index. It is often stated that synthetic ETFs are exposed to additional counterparty risk, as the ETF sponsor is required to enter a total return index swap with a counterparty. Despite being true, physical ETFs engage in security lending, therefore being similarly exposed to counterparty risk. Blocher and Whaley (2016) show that the on average lending fees of ETF sponsors are as high as their expense ratio - or even higher. Today, over 80% of ETFs total assets are invested in physical ETFs. Synthetic ETFs are only predominant in the money market and commodity asset classes (Riedl (2018)).

Figure 3. Share creation and redemption process of a physical ETF
This figure depicts the structure of a physical ETF. The Authorized Participant and the ETF provider (sponsor) form the primary market. The secondary market consists of the investors and the exchange. Source: Own depiction based on (Foucher and Gray (2014)).
Despite the distinction between physical and synthetic ETFs, the underlying architecture of both types can similarly be subdivided into a primary and a secondary market. The primary ETF market consists of the ETF sponsor (provider, manager) and the so-called Authorized Participant (AP), usually a market-maker or large financial institution. In the primary market, the ETF provider (e.g. Blackrock, ProShares, Vanguard) enters into a legal contract with the AP, which in turn interacts directly with the financial market. The ETF provider can create newly issued shares when the AP deposits the basket of underlying to the sponsor (share creation). Following the share creation, the AP can hold the newly created ETF share or sell them on an exchange (secondary market). Share redemption works the other way around. The AP redeems shares by transferring ETF shares to the ETF sponsor, receiving in turn the underlying securities (Lettau and Madhavan (2018)). The primary market share creation/redeemption process usually occurs in blocks of 50'000 ETF shares. The creation basket specifies the shares and the number of shares that the AP needs to deposit to the ETF sponsor. Notice that there can be multiple APs interacting with the ETF provider. Antoniewicz and Heinrichs (2014) document that on average, each ETF provider has 34 APs. Fig. 3 depicts the structure of physical ETFs and how new ETF shares are created/redeemed on the primary market.

The above mentioned ETF structure gives rise to its unique arbitrage mechanism. Imagine that ETF shares are traded at a premium to the Net Asset Value (NAV). The AP can realise arbitrage profits by investing in the underlying stocks, delivering them to the ETF provider and receiving newly created ETF shares in exchange. Selling the ETF shares on the secondary market puts downward pressure on the shares resulting in alignment between NAV and the price of ETF shares. Similarly, when ETF units are priced below NAV, the AP buys ETF shares and redeems them for the underlying securities. It is not required to be an AP to realise such arbitrage profits. High-frequency traders can similarly capitalise on the divergence between ETF share prices and the NAV, by merely short selling the expensive and buying the cheaper one (cf. fig. 4). The just mentioned statistical arbitrage accounts for 50% of the SPY ETF trading volume. During trading days, ETF sponsors publish their NAV every 15-seconds, fostering arbitrage activity and lowering tracking errors (Ben-David et al. (2018)).
This figure depicts an arbitrage opportunity in the ETF market. ETF shares are priced at a premium compared to the NAV (panel A). APs, high-frequency traders or hedge funds can profit from such a situation going short the ETF and long the underlying securities. In the long-run, both prices will converge to the fundamental value (panel B).

For synthetic ETFs, the arbitrage mechanism on the secondary market is the same as for physical ETFs. Fig. 5 depicts the structure of a synthetic ETF. In addition to the physical ETF, the ETF provider is required to enter a total return swap with a counterparty. Due to the fact, that most ETFs replicate the underlying index physically I will not further discuss the structure and mechanism of synthetical ETFs.

The arbitrage mechanism mentioned above between ETF shares and their underlying might give rise to some desirable but also undesirable effects of ETFs on their underlying securities. In the following section, I will review the academic literature on how ETFs affect the financial market. For a more detailed overview of the mechanics, structure and types of ETFs, I refer the interested reader to Lettau and Madhavan (2018), Foucher and Gray (2014) and Antoniewicz and Heinrichs (2014).
Figure 5. Share creation and redemption process of a synthetic ETF
This figure depicts the structure of a synthetic ETF. The Authorized Participant, the ETF provider (sponsor) and the swap counterparty form the primary market. The secondary market consists of the investors and the exchange. Source: Own depiction based on (Foucher and Gray (2014)).
III. Reviewing the existing literature

In the following section, I will present the findings of academic papers analysing how ETFs affect their component stocks. The papers are grouped into six sub-categories according to their investigated effect (cf. fig. 2).

A. Liquidity

Boehmer and Boehmer (2003) investigate the introduction of 30 ETFs (AMEX-listed) on the New York Stock Exchange (NYSE). Following the introduction of these ETFs, the authors find a considerable increase in market liquidity and quality. Spreads (quoted, effective and realized) declined by a double-digit percentage, price impact decreased and quoted depth increased. Similarly, Hegde and McDermott (2004) exploit the introduction of the DIAMONDS (Q) ETF in 1998 (1999). Consistent with the arbitrage hypothesis, the authors find that following the introduction of these ETFs, the market liquidity of component stocks significantly improved over the first 50 trading days. This work was extended by Richie and Madura (2007), who find that stocks that are less weighted in the QQQ ETF experienced a stronger increase in liquidity compared to heavier weighted stocks - indicating an asymmetric liquidity effect. Marshall, Nguyen, and Visaltanachoti (2015) analyse the liquidity of over 800 ETFs, including also sector equity, commodity, real estate and bond ETFs. The results reveal a strong positive correlation between the liquidity of the ETF and the underlying securities. Moreover, the authors document reciprocity between ETF and underlying securities liquidity: ETFs liquidity affect the liquidity of the underlying but are also affected by the latter.

Hamm (2012) takes a closer look at the liquidity of individual securities and how they are affected by ETF holdings. Securities included in an ETF exhibit higher liquidity compared to similar securities that are not included in an ETF. However, these findings might be endogenously driven. Agarwal, Hanouna, Moussawi, and Stahel (2018) examine the effect of ETF ownership on liquidity and find that ETF ownership increases liquidity comovement of the securities through the arbitrage channel. Consequently, giving rise to additional liquidity risk that can not be diversified away. These findings can be interpreted causally, as the authors use the reconstitution of the Russel 1000 and Russel 2000 index as a natural experiment, capturing exogenous variation in ETF ownership. Furthermore, the authors show that these results are independent of the ownership by mutual funds and large institutional investors. Lastly, Agarwal et al. (2018) show that an increasing arbitrage activity in the primary and secondary market of ETFs is associated with higher commonality in component stocks liquidity.
A comprehensive study on the effect of ETF holdings on liquidity, firm value and volatility is provided by Bae, Wang, and Kang (2012). The authors show that the level of ETFs holding in the corresponding stock negatively affect firm value (measured by Tobin’s-q) but increases liquidity and systemic volatility.

Overall, most papers agree that ETFs improve the liquidity of its underlying basket of securities. However, Flash Crashes (e.g. May 6th, 2010 and August 24th 2015) have demonstrated how liquidity provision by ETFs is affected by extreme market turbulence (CFTC (2010a), CFTC (2010b)). The following subsection presents the academic literature analysing ETFs during times of financial distress (cf. sec. III.B).

B. Financial distress

Despite being known for being highly liquid, ETFs have experienced significant illiquidity during times of financial distress. The 9% drop of the DJIA during the Flash Crash in 2010, has triggered price dislocations and illiquidity of ETFs. Equity-based ETFs that invested into domestic securities were disproportionately affected (CFTC (2010a), CFTC (2010b)). Following the Flash Crash in 2010, the SEC imposed the rule that specific securities and ETFs with high volatility will stop being traded. The first time, this new rule came into play was on August 24th, 2015 when over 300 ETFs stopped being traded. Borkovec, Domowitz, Serbin, and Yegerman (2010) support the view of the SEC, documenting increasing spreads and significant illiquidity of ETFs during the Flash Crash in 2010. A potential reason for the dry-up of the order book is provided by Pan and Zeng (2017). The author analyse in detail how the arbitrage activity of APs deteriorates with increasing illiquidity of the underlying securities. When markets are volatile, the trading volume of APs significantly declines, increasing potential liquidity risks during times of financial distress. Similarly, Ben-David, Franzoni, and Moussawi (2012) document that arbitrageurs significantly reduce their trading activity during periods of market distress, potentially worsen the liquidity and market situation. In their Internet Appendix Ben-David et al. (2018) provide evidence that during periods of financial distress, stocks with high ETF ownership exhibit higher negative skewness. This can be interpreted as a destabilising mechanism of ETFs on securities. Furthermore, Madhavan (2012) shows that when markets are fragmented, ETFs that were linked to highly illiquid stocks lost significant trading volume and price dislocations. Finally, Dannhauser (2016) investigates the corporate bond market in more detail. The results reveal that following the introduction of corporate bond ETFs, liquidity trader participation decreased but informed investor ownership increased.
C. Price discovery

Additional liquidity provision by ETFs might positively affect price discovery in the component securities. Fig. 6 depicts the price discovery hypothesis according to Ben-David et al. (2018). Imagine a fundamental shock hits the component securities included in an ETF (fig. 6, panel B). Under the price discovery hypothesis, the price of ETF shares react at first to the fundamental shock (fig. 6, panel C). Arbitrage between ETF shares and the NAV will result in a new equilibrium (fig. 6, panel D).

![Figure 6. Price discovery hypothesis](image)

This figure depicts how a fundamental shock propagates under the price discovery hypothesis. In the initial equilibrium (panel A), ETF price and NAV are aligned. A fundamental shock occurs (panel B) and price discovery happens in the ETF market first (panel C). Through arbitrage, ETF and NAV align in the new equilibrium (panel D). Source: Own depiction based on Ben-David et al. (2018).

Madhavan and Sobczyk (2014) developed and tested empirically a dynamic ETF price model, whereby arbitrage corrects the price difference between ETF shares and the underlying. The authors show that ETFs can accelerate price discovery of securities, as long as
arbitrage is frictionless. Empirical evidence suggests that on average price discovery is the fastest (shortest) for US equity (international bond) ETFs. These findings were confirmed by Glosten, Nallareddy, and Zou (2015), who document that higher ETF trading activity results in a higher information efficiency of the underlying securities. The authors argue, that securities included in an ETF reflect more systematic fundamental information, which is especially relevant for small firms. In other words, ETFs improve the information efficiency of component stocks. Wermers and Xue (2015) empirically study the lead-lag relation between the ETF price and the underlying securities to disentangle informed from noise trades. Under the assumption that informed investors trade ETF, the authors conclude that when ETFs lead the underlying security prices, informed trades dominate noise trades. Conversely, when the index leads the ETF, noise trading dominates. Although noise trading does affect ETF prices, the effect is much weaker than for informed trades. Overall, Wermers and Xue (2015) find that the price impact of noise traders is weak and reverting.

In contrast, Israeli, Lee, and Sridharan (2017) discover the dark side of ETFs, finding that ETF owned stocks are characterized through a higher correlation with the index, lower informational efficiency and lower analyst coverage. Deville, Gresse, and de Séverac (2014) analyse the effect of the first introduction of an ETF tracking the CAC 40 index on price efficiency in future markets. Despite significant improvement in price efficiency in the future market after the introduction of the ETF, the authors do not attribute this improvement to arbitrage trades in the ETF market. Interestingly, Bradley and Litan (2012a,b) argue that ETFs are driving the prices of the underlying but it should be the other way around - prices of the underlying securities should drive the price of ETF shares. Due to the large volume and influence of ETFs, private firms avoid going public as large ETFs would disrupt prices of small-company stocks. Finally, Ben-David et al. (2018) provide evidence against the price discovery hypothesis. I will present their results in the following subsection.

To sum up, the literature on the effect of ETFs on market efficiency is controversial. On the one hand, some argue that the additional layer of liquidity provided by ETFs enhances price discovery. On the other hand, some findings reveal that noise trading can decrease component stock information efficiency. In the following subsection, I show that possibly both phenomena coexist.
D. Volatility

Malamud (2015) develops a dynamic equilibrium model according to fig. 3. In their model, the ETF sponsor can create and redeem ETF shares via the AP. The interaction between the ETF sponsor and the AP serves as a shock propagation channel, where demand shocks are propagated on the underlying prices. The author shows that via the arbitrage channel, ETFs can affect the volatility of component stocks. Moreover, Malamud (2015) documents that the shock propagation is positively dependant on the liquidity of the underlying securities. Malamud (2015) concludes that non-fundamental shocks at the ETF level propagate via the arbitrage channel to the underlying securities, resulting in higher volatility of component stocks.

Empirical evidence of spillovers from ETFs to their underlying is provided by Krause, Ehsani, and Lien (2014). The authors apply the methodology of Diebold and Yilmaz (2012) to create a directional volatility spillover table. According to the spillover table, significant volatility spillovers originate from ETFs resulting in increased volatility of the largest underlying securities. However, as the authors state themselves, one can not conclude from their presented findings that ETFs increase the volatility of the underlying securities. An empirical setting is required, whereby through an exogenous shock a stock will be newly included/excluded from the ETF. Such an empirical setting was used more recently by Ben-David et al. (2018).

Ben-David et al. (2018) investigate the impact of ETFs on the volatility of the underlying securities. According to the liquidity trading hypothesis, non-fundamental shocks at the ETF level may lead to higher volatility of the underlying. Fig. 7 depicts the liquidity trading hypothesis. In the initial equilibrium, the ETF price and NAV are at their fundamental value (fig. 7A). When a demand shock (e.g. hedge funds invest into the ETF) hits the ETF, ETF prices will rise above the fundamental value (fig. 7B). In this situation, arbitrageurs short ETF shares and invest in the underlying securities. Arbitrage will result in an alignment between ETF price and NAV (fig. 7C). In the long-run, both prices will revert to their fundamental value (fig. 7D). Consequently, increasing ETF ownership might positively affect the volatility of the underlying securities. However, this is only the case if ETFs attract new short-horizon investors that have previously not traded the underlying. Notice, that the price discovery hypothesis, as well as the liquidity trading hypothesis, imply higher volatility of securities with high ETF ownership. A whole section of the authors paper is devoted to disentangling noise trades form informed trades.
First, Ben-David et al. (2018) regress daily volatility of securities on ETF ownership (at the end of the previous month) while controlling for index fund, active fund and hedge fund ownership. The results show that for S&P500 (Russell 3000) stocks, a one-standard-deviation increase in ETF ownership is associated with 16.4% (7.8%) of a standard deviation increase in volatility. Second, following Chang, Hong, and Liskovich (2015) and Appel, Gormley, and Keim (2016), the authors make use of the yearly index switching mechanism of the Russell 1000 and 2000. Despite the fact, that the Russell 1000 includes higher capitalised securities, ETF ownership for the largest securities in the Russell 2000 is higher compared to the smallest stocks in the Russell 1000 (Chang et al. (2015)). Using a two-stage OLS regression, Ben-David et al. (2018) document that the effect of ETF ownership on volatility is significant for securities in the Russell 1000 as well as the Russel 2000. Consequently, the results can be interpreted causally - ETF ownership positively affects the volatility of the underlying securities. Moreover, Ben-David et al. (2018) show that the increasing volatility of the securities is not a result of an enhanced price discovery mechanism. Contrary, non-
fundamental flows are responsible for the increasing price volatility of the underlying. By detecting a mean-reverting component, the authors confirm the liquidity trading hypothesis. Finally, Ben-David et al. (2018) sort stock into quintiles based on their level of ETF ownership, showing that a long-short portfolio earns a monthly return premium of 56 basis points. Consequently, investors are compensated for carrying non-diversifiable volatility risk that arises through ETF ownership.

Lin and Chiang (2005) analyse the introduction of the first Taiwanese ETF (TTT) in June 2003. Following the introduction of the TTT ETF, for 61.2% of component stocks volatilities significantly increased compared to the pre-TTT period. Interestingly, volatility changes are sector dependant, being the highest (lowest) in the electronic and financial (mixed) sector. Further evidence on the effect of ETFs on component stocks volatility is provided by Wang and Xu (2019) for the Chinese market.

E. Comovement

Academic papers have shown that adding new stock to an index increases its correlation to stocks previously included in the index. Barberis, Shleifer, and Wurgler (2005) provide evidence that the inclusion of a stock in the S&P500 increases the stock market beta by 0.2 (sample period: 1988 - 2000). Interestingly, looking at the sample period from 1976 - 1987, average daily market beta increase of only 0.07. Greenwood and Sosner (2007) use the redefinition of the Nikkei 225 index, showing that the betas of newly added (removed) stocks increased (decreased) on average by 0.45 (0.63). Moreover, the rise of index investing does not only increase comovements, but it is also reflected in a significant index membership premium of close to 40% (Morck and Yang, 2001). Wurgler (2010) concludes that despite the diversification potential index-investing offers, adding small-caps to an index destroys their current diversification potential. For the commodity market, Adams and Glück (2015) document that due to the finalization of the commodity market, the comovement between commodity and equity markets significantly increased. The authors argue that this can be explained by the style effect of large investors.

With respect to ETFs, Da and Shive (2013) identify the arbitrage opportunity between ETF shares and the underlying securities as a new source of increasing return correlation. Using intraday data, Staer and Sottile (2018) find that a higher ETF turnover is associated with an increase in stock return comovement. The authors use a DCC model according
to Engle (2002) to measure the correlation among individual securities. Despite the scarce literature on how ETFs affect the correlation structure among the underlying securities, the story is similar to the previously mentioned literature. With the total assets of ETFs exceeding $3.7 trillion, ETFs may further increase the comovement of securities included in indices (Wurgler (2010)).

F. Leveraged ETFs

Especially leveraged ETFs were accused of creating volatility spikes during the financial crisis in 2008. Leveraged ETFs rely on leverage or derivatives achieving higher, respectively lower returns compared to the underlying index. Leveraged ETFs usually have a multiple 2 (3), realising a return of 2% (3%) when the underlying index rises by 1%. Similarly, also short strategy ETFs - so-called bear (leveraged inverse) ETFs - are available (Ben-David, Franzoni, and Moussawi (2016)).

Leveraged ETFs are required to rebalance their portfolio at the end of the trading day, which is executed as near as possible to market close. Traditional ETFs (physical or synthetic) are not required to perform such a daily rebalancing. Intuitively, these end-of-day flows of leveraged ETFs may positively affect liquidity and volatility of component stocks. Indeed, Cheng and Madhavan (2009) develop a model, showing that the rebalancing of leveraged ETFs has a large impact on market-on-close volume, liquidity and volatility of the underlying securities. Moreover, the effects are proportional to the assets invested in leveraged ETFs. The academic literature is not limited to the equity market. Curcio, Anderson, Guirguis, and Boney (2012) show that the introduction of leveraged as well as traditional real estate ETFs have positively affected the volatility of the real estate stocks. Moreover, leveraged ETFs affected the volatility stronger than traditional ETFs. For commodity markets, Chan, Shelton, and Wu (2018) find that the financialisation affected especially the volatility of non-energy commodities.

Contrary, an empirical analysis by Trainor (2010) provides no evidence that leveraged ETFs are responsible for volatility spikes in the last 30 minutes during the trading day. Using intraday data the author finds similar volatility spikes during non-rebalancing periods compared to rebalancing periods of leveraged ETFs. Moreover, Trainor (2010) argues that despite the growth of leveraged ETFs, abnormal market volatility has diminished. However, the authors also point out that with an increasing market share of leveraged ETFs volatility spikes may occur in the future.
IV. Conclusion

ETFs have become a predominant investment vehicle for passive investors, seeking high liquidity and low transaction costs. The exponential growth of ETF investments, coupled with recent Flash Crashes has attracted much research on how ETFs affect the financial market. This literature review synthesizes the academic literature on ETFs and their relation to the underlying securities. I grouped the academic literature into five main strands (liquidity, financial distress, price discovery, volatility & comovement). Furthermore, I present some recent findings on leveraged ETFs that complement the current literature on traditional ETFs.

Overall, most papers agree that ETFs improve the liquidity of its component stocks during non-turbulent market times (e.g. Hegde and McDermott (2004), Richie and Madura (2007)). In times of financial distress, the liquidity provision of ETFs can deteriorate, resulting in increasing illiquidity of ETFs which transmits to the underlying securities (e.g. Pan and Zeng (2017)). The price discovery (liquidity trading) hypothesis argue, that ETFs increase (decrease) market efficiency. Although these hypotheses are contradictory, it is plausible, that both phenomena coexist. On the one hand, the literature finds that ETFs increase liquidity and information efficiency. On the other hand, since noise-traders use ETFs as an investment vehicle, non-fundamental information is reflected in the prices. Securities that are included in an ETF might incorporate fundamental information faster but at the same time are affected by additional non-fundamental noise trades. Ben-David et al. (2018) provide a very detailed analysis of how ETFs increase the volatility of the component securities. The authors confirm that both phenomena exist. However, by decomposing the information efficiency gain from the non-fundamental effect of ETFs the authors find that increasing volatilities in the security basket are the result of non-fundamental information. Finally, the academic literature found that following the inclusion of a stock in an index, its correlation with stock included in the index increases. The continuous growth of passive investments and ETFs may enforce this entity.

Since the academic literature has often exclusively focused on equity-based ETFs, a more detailed investigation of bond, commodity and money-market ETFs would complement current findings. Further research is also required in the field of leveraged ETFs. Despite the late introduction of leveraged ETFs in 2006, examining the effect of leveraged ETFs on volatility would consolidate current results in the literature and would help policymakers to understand the systemic risk ETFs bring along.
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