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ETFs AND SYSTEMIC RISKS

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FOREWORD

The global financial crisis unleashed economic, social, cultural, political, and maybe even constitutional problems and change. That, in today's world, anything like it could happen was an indictment of politicians, policymakers, bankers, and asset managers. It rightly prompted an overhaul of the regulatory system, with higher levels of equity and liquidity required in the banking system and a new regime for resolving distressed firms without taxpayer solvency support (bailouts). But policymakers, perhaps especially in the United States, neglected to take seriously the threats to economic stability from so-called shadow banking, which replicates the inherent fragility of banks (due to leverage, liquidity mismatch, and opaque assets) without being subject to the same constraints. The policy challenge is how to address those threats without curbing the freedom of capital markets to allocate resources efficiently. As part of making progress with this challenge, a lot of ground clearing is needed, including analysing different parts of the asset management industry. No such endeavour could be serious unless it covered exchange-traded funds, which have changed the investment management landscape and which attracted the interest of international policymakers a decade ago. This paper contributes to that badly needed debate and is thus very welcome.

Sir Paul Tucker, Chairman,
Systemic Risk Council

ETFs AND SYSTEMIC RISKS

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1. INTRODUCTION

The foundations of our present understanding of financial markets lie in the classic theories of portfolio choice (Markowitz 1952) and market general equilibrium (Treynor 1999; Lintner 1965; Sharpe 1964). A basic insight from these theories is that an asset's price can be decomposed into two factors: (1) an idiosyncratic factor specific to the asset and (2) a systematic factor common to all assets in the market. In a mean–variance world, this insight implies that the optimal portfolio choice for all market participants should be some combination of a risk-free asset and a well-diversified market portfolio. A straightforward explanation for the introduction of—and subsequent explosion in demand for—index products such as exchange-traded funds (ETFs) is the need for such well-diversified portfolios. As happens often in economics, such an explanation, while broadly true, glosses over many finer details of the story—and the devil, as always, is in the details.

No explanation can easily be found for the association, observed lately, between disruptions in ETFs and disruptions in underlying markets in the simple account just presented.[1] Do ETFs affect systemic risks in financial markets, and if they do, via what mechanism? How robust are our markets to the risks, and what can we do to keep the risks under control? Are certain markets more prone than others to such risks? In this paper, we dig deeper into ETFs to examine such questions. One could go about this task in multiple ways—from citing empirical evidence in markets to analyzing mathematical models of ETF trading. We choose a middle ground here, favoring explanations well-grounded in economic theory that can nevertheless be examined in light of existing empirical evidence.

The core issue with ETFs is best explained using an analogy. When the first Standard & Poor's Depositary Receipt (SPDR) ETF was launched in 1993, index products were envisioned as passengers in a car driven by underlying markets. Because of a multitude of factors, the roles have now reversed in many markets, with ETFs in the driver's seat and underlying markets relegated to the status of mere passengers. ETFs

[1]See the examples in Section 2 of this paper. See also Eva Su, "Exchange-Traded Funds (ETFs): Issues for Congress," Congressional Research Service Report R45318 (24 September 2018), which discusses the links between ETFs and underlying price movements during recent events of market stress. Available at https://fas.org/sgp/crs/misc/R45318.pdf.

were admitted into the car as passengers, which means they never had to pass a rigorous driving test. In other words, we do not know how well they drive. Further, given that they now occupy the driver's seat in many markets as a fait accompli, asking them to stop and take a proper test risks bringing the car to a complete halt. Under such conditions, how do regulators decide which ETFs really know how to drive, and how do we deal with the ones that seem to be dodgy drivers?

An index product such as an ETF, by its very nature, emphasizes the systematic factor over idiosyncratic factors. This is because, in a basket, the idiosyncratic factors cancel each other out, leaving the systematic factor as the central determinant of price. When index products become the chief driver of markets, the systematic factor becomes the key mover of not just index prices but also all underlying asset prices. This is a problem because an asset's price is then less reflective of the specifics in that asset market. Furthermore, as the distinctiveness of assets gets lost, traders can more easily engage in speculative herding strategies. Herding behavior is what turns potential weaknesses into systemic risks, allowing problems in one market to easily spill over into other markets.

While all index products share the basket feature, what sets an ETF apart is the extreme efficiency in its design. A closed-end mutual fund does not issue new shares; an open-end mutual fund adjusts its net asset value (NAV) just once a day; an index future is inherently forward looking. One way to think about these features in other index products is that they represent design shortcomings. Right from the beginning, ETFs were conceived as products that should overcome such issues. However, these very shortcomings also indirectly act as safety valves, making the other index products less prone to speculative herding strategies. For example, when the NAV adjusts only once a day, herding is too risky to be attractive to speculators. In doing away with these inefficiencies, an ETF also does away with safety valves that could impede the transmission of shocks when markets get disrupted. Recognizing this dichotomy—of features that enhance market performance while potentially undermining market stability—is a key insight of this paper.

Recently, market regulators have experimented with various tools to contain the outbreak of disruptive spirals. Rules on circuit breakers have been tweaked repeatedly to make them more potent. Still, the risk of collateral damage to trading from badly designed trading halt rules remains worrying. Moreover, questions arise as to whether we have the right "rules of the road" for what is driving markets. Ultimately, the quality of trading in an ETF reflects the quality of the underlying asset markets, especially in times of stress. Thus, long-term remedies to the problem must address issues of market quality in the underlying: Determinants such as liquidity, depth, and transparency, among others, need to be certifiably good for ETFs to work well.

The writing on ETFs has grown exponentially in the past five years and today includes a wide mix of articles in academic journals, industry magazines, and the popular press. Further, a large body of related work looks at various issues in the broader passive investment industry. We do not attempt to provide exhaustive coverage of the literature in this paper, nor do we aspire to address every concern that has been raised about ETFs' possible negative impacts. Instead, we aim to present what we think are some substantive issues specifically related to ETFs and systemic risks. A particular focus here will be on the behavior of ETFs in times of market disruption. Correspondingly, we also discuss whether

features of ETFs can themselves lead to such perturbations in the market. In addition, we raise some emerging ETF issues that pose important questions about potential market impacts. If ETFs are now driving markets, knowing where they, and the markets, are going is important.

This paper is organized as follows. Section 2 discusses four recent episodes of market disruption involving ETFs. Section 3 provides a brief overview of the structure of an ETF. Section 4 examines the academic theory behind coordination and speculative herding in ETF markets, as well as the market conditions under which herding is likely to be severe. Section 5 discusses some of the systemic risks that may relate to ETFs' particular design and considers whether ETFs can be a source of market disruption. Section 6 compares various tools a regulator can use to deal with episodes of market disruption and draws attention to some emerging risks in ETFs. Section 7 recaps our main findings and provides recommendations for regulators. Section 8 concludes this paper by asking whether we have the right "rules of the road" to deal with the new drivers of market behavior.

2. ETFs AND MARKET DISRUPTIONS: SOME REPRESENTATIVE EXAMPLES

In this section, we briefly describe four different episodes of market disruption involving ETFs. Although each episode involves a different underlying asset class, the underlying similarities in the incidents are easily recognizable.

On the morning of 24 August 2015, the US equity and futures markets experienced exceptional price volatility, with the Dow Jones Industrial Average witnessing its largest intraday decline in history. While such volatility in itself was unprecedented, what was even more unsettling were the extreme concomitant movements in some of the largest ETFs in US markets. In less than an hour of trading, 20 of the 50 largest ETFs declined by 10% or more, and close to one-fifth of all ETFs witnessed price changes large enough to trigger trading halts. In total, short-sale restrictions were triggered in more than 2,000 securities in the broader market that together represented close to 40% of the capitalization of the S&P 500 Index. The SEC research note titled "Equity Market Volatility on August 24, 2015" provides a detailed description of the events of that day.[2]

In the summer of 2013, in an unexpected announcement, the chairman of the Federal Reserve Board proposed that the Fed taper its asset purchases under the quantitative easing program. The sudden change in investor expectations about monetary policy led to a massive churn in the bond market, causing dramatic spikes in yields. In less than a month, US$23.7 billion flowed out of bond funds, and the yield on the benchmark 10-year Treasury note crossed 2.6% in late June 2013, surging from 1.6% in May. Importantly, the outflows in ETF bond funds seem to have significantly exacerbated the bond yield spreads. Dannhauser and Hoseinzade (2017) analyzed this episode and found that "a one standard deviation increase in ETF Tantrum outflows [led] to a 12.4 basis point greater increase in the yield spread of corporate bonds in September 2013" (p. 4).

On 5 February 2018, the Cboe Volatility Index (VIX) shot up by 20.01 points. This was a stark reversal of the trend of previous years, when volatility declined steadily. In fact, by 2017, US

[2]Office of Analytics and Research Division of Trading and Markets, "Equity Market Volatility on August 24, 2015," SEC research note (December 2015). www.sec.gov/marketstructure/research/equity_market_volatility.pdf.

stock market volatility had declined to a five-year low. To profit in such tranquil environments, a number of inverse VIX ETF products were structured to essentially act as hedges against a stock market decline. Among the largest were the VelocityShares Daily Inverse VIX Short-Term ETN (exchange-traded note), popularly known by its ticker XIV, and the ProShares Short VIX Short-Term Futures ETF, better known as SVXY. When the VIX began its upward spike on 5 February, investors in these products seemed to be caught unaware, prompting a rush to redeem and get out of the ETF products. The data from this episode need more careful analysis, but anecdotal evidence seems to suggest a feedback loop at play due to the rebalancing needs of the ETFs, which amplified the buying pressure on the VIX. The overall effect was a 96% gain in the index, the largest in its history.[3]

In the spring and summer of 2018, Turkey saw sharp declines in the value of its currency as its central bank, faced with unprecedented political interference in its functioning, seemed unable to raise interest rates sufficiently to counteract selling pressure in the currency. In mid-August 2018, Standard & Poor's cited "extreme lira volatility" and decided to lower its rating on Turkey to BB–, and on 23 August 2018, the Turkish lira fell more than 8% against the US dollar, stoking fears of a deep recession.[4] While economic mismanagement in emerging markets is by no means a fresh phenomenon, what seemed new were the huge bets in play in US-traded Turkish ETFs. For example, the iShares MSCI Turkey ETF, a US$300 million fund, saw inflows of more than US$160 million in a single week in August 2018, with US$90.3 million coming in on a single day.[5] Although rigorous empirical analysis of such emerging market ETF episodes is not yet available, the anecdotal picture that emerges seems to be in stark contrast to the passive, neutral role ETFs were expected to play in markets.

These examples highlight a troubling fact: ETFs are playing a role in episodes of market instability. What is less clear is whether ETFs' role is that of innocent bystander, active participant, or primary instigator. In this paper's subsequent sections, we set out to determine the answer. To do so, we must first understand what makes ETFs different from other investment vehicles.

3. STRUCTURE OF ETFs

ETFs feature a special structure, and ultimately, both the positives and negatives of this instrument can be traced to the distinctness of its design. In this section, we provide a brief overview of the ETF market structure. Subsequent sections identify key attributes in this structure that may come into play, reacting to, or even causing, market disruptions.

An ETF originates when an issuer (ETF sponsor) designates chosen market participants as ETF market makers (authorized participants). Authorized participants have a special agreement with the ETF issuer: They can create and redeem ETF shares in a *primary market*. Such creations and redemptions happen either when authorized

[3]Luke Kawa and Tracy Alloway, "How Two Tiny Volatility Products Helped Fuel the Sudden Stock Slump," Bloomberg (7 February 2018). www.bloomberg.com/news/articles/201802-07/how-two-tiny-volatility-products-helped-fuel-sudden-stock-slump.

[4]Jessica Dye, "S&P, Moody's Send Turkey Deeper into Junk Territory," *Financial Times* (17 August 2018). www.ft.com/content/9ed3b3e2-a25b-11e8-85da-eeb7a9ce36e4.

[5]Ryan Vlastelica, "Turkey ETF Sees Highest Inflows in 5 Years amid Currency Crisis," MarketWatch (15 August 2018). www.marketwatch.com/story/turkey-etf-sees-highest-inflows-in-5-years-amid-currency-crisis-2018-08-15. See also Rachel Evans and Carolina Wilson, "How ETFs Became the Market," Bloomberg (13 September 2018). www.bloomberg.com/graphics/2018-growing-etf-market/.

participants deliver the constituents of the ETF to the sponsor—termed an *"in-kind" transaction*—or when they offer the NAV equivalent of cash—termed an *"in-cash" transaction*. The ETF sponsor itself must obtain the replicating basket when the transaction is in cash. Creation/redemption usually follows a predefined procedure specified in the authorized participant contract: It often happens in predefined large blocks (typically 50,000 ETF shares or more), at designated times (usually end of day), and at designated prices (usually end-of-day closing prices or next-day opening prices). Historically, most ETFs allowed only in-kind creations/redemptions; nowadays, many allow cash redemptions or a mix of the two types.[6] Physical replication has been the traditional design method for ETFs since their conception, and physical replication ETFs still make up the most popular category in the market. However, more recently, various new products have been conceived under the heading of "synthetic" ETFs. In such ETFs, sponsors do not necessarily hold the replicating basket, and they rely on derivatives such as swaps to track an underlying index.[7]

Most of the visible action in ETFs takes place in *secondary markets*—markets where investors trade ETF shares that have already been created in the primary market. ETFs are listed products, and anyone with access to the stock exchanges can buy or sell ETFs in the secondary markets. The key innovation in ETFs lies in this clever separation of trading into two markets—primary and secondary—which are nevertheless joined dynamically because of arbitrage by authorized participants. When ETFs and underlying asset markets are liquid and easily accessible, authorized participants can profit from any price difference between the underlying basket and the ETF. For instance, if the ETF is trading at a premium, authorized participants would sell short the ETF while simultaneously buying the underlying securities. At the end of the day, authorized participants would deliver the basket of securities to the sponsor in exchange for ETF shares, thus closing out the short position for a profit. In theory, such trading means that ETF and underlying prices must move in lockstep.

In reality, the ETF arbitrage procedure involves several frictions. For example, block size requirements for creation/redemption imply that authorized participants might have to carry inventory on their books for extended periods of time. An ETF and its underlying basket of stocks often do not trade synchronously when they are listed on different exchanges, sometimes complicating the arbitrage trade. Further, when underlying asset markets are illiquid and difficult to access, a new layer of rigidity gets added to the arbitrage and trading procedures. These frictions and rigidities may have inventory effects (due to inventory management by risk-averse dealers) as well as informational effects (due to the staggered aggregation of information in the markets).

These frictions suggest that ETFs are unlikely to be "innocent bystanders" in markets. Instead, the mechanics of ETF creation and redemption, as well as the very role ETFs play in enabling new types of investment activity, mean that ETFs will actively influence markets. To understand the extent of this impact, we turn to examining how ETFs can affect market behavior more generally.

[6]For more details on the creation/redemption process, see Mara Shreck and Shelly Antoniewicz, "ETF Basics: The Creation and Redemption Process and Why It Matters," ICI Viewpoints (19 January 2012). www.ici.org/viewpoints/view_12_etfbasics_creation.

[7]A good introduction to synthetic ETFs is provided in "Synthetic ETFs," FEDS Notes, Board of Governors of the Federal Reserve System (10 August 2017). www.federalreserve.gov/econres/notes/feds-notes/synthetic-etfs-20170810.htm.

4. COORDINATION AND MARKET HERDING

Many of the basic theoretical tools in economics for understanding phenomena such as herding and speculation come from an area in game theory that studies coordination in games. Early work on the topic, such as Schelling (1980), and later advances, such as Morris and Shin (1998) and Angeletos and Werning (2006), show how such tools provide a useful vocabulary for thinking about self-fulfilling prophecies. Typically, the setting is a game of incomplete information, where one player's payoff depends not only on that player's own actions but also on the actions of others, as well as on uncertain economic fundamentals. Players receive correlated signals about these fundamentals, and the game theoretic framework allows one to analyze the equilibria that ensue. Of special interest are equilibria in which players end up choosing similar actions, successfully executing phenomena such as speculative attacks, despite the absence of overt communication.[8] In the context of asset pricing, Froot, Scharfstein, and Stein (1992) offered an early model that formally demonstrated the possibility of such speculative herding.

A key idea in such models is the concept of a coordinating device, sometimes called a *focal point* in the literature. Focal points are simply tools used for coordinating actions—captured, for example, by admonitions such as, "If anyone gets lost, let's all agree to meet under the sign at the entrance." In our setting, focal points are signals common to all players in a game that enable the players to coordinate their strategies. The crucial insight developed in Bhattacharya and O'Hara (2016) is that the systematic factor signal can function as a coordinating device in a market with index products such as ETFs. This provides speculators with a new type of trading strategy, the concerted trade, where a speculator in one market buys or sells in anticipation that speculators in other markets will buy or sell (Bhattacharya and O'Hara 2019). Multiple equilibria exist in such markets, but one equilibrium with particular importance is a herding equilibrium in which speculators all take similar action (i.e., all selling or all buying at the same time). Such herding outcomes are not typically easy to sustain, but when index products dominate the landscape and information transmission is staggered, coordinating on the systematic factor signal becomes more profitable for market participants, thereby making herding more likely.

Both these conditions are more plausible if the underlying markets are inherently difficult to access or if an upheaval occurs in an otherwise liquid underlying market. And among index products, ETFs play the main role in such market conditions. This is because ETFs have increasingly become a vehicle of choice to open up markets hitherto inaccessible to general traders (as in the third and fourth examples in Section 2, involving the VIX and emerging market ETFs). In addition, when upheavals occur, ETFs are usually the only accessible indexes in the markets trading in real time (as in the first and second examples in Section 2, involving large-cap and bond ETFs).

While speculative herding is a novel feature enabled by ETFs, the other equilibria in such markets display many well-known, long-term characteristics of trading with a large passive participation. Theoretically, such equilibria reflect a famous result in Grossman and Stiglitz (1980): At the boundary, if everyone were a passive investor, prices would get completely delinked from fundamentals, and we would end

[8]While general coordination games feature multiple equilibria, the global games approach to this topic, pioneered in Morris and Shin (1998), picks a unique equilibrium that displays coordination.

up with a market failure. Critics of ETFs argue that even when the market is not at the boundary, large volumes in passive trading mean that we could be losing out on informational efficiency in prices.[9] When asset prices become untethered from fundamental values, markets no longer serve their crucial role of efficiently allocating capital, and this loss can have an important long-term impact.

Results like those in Grossman and Stiglitz (1980), however, depend on the information revelation process in a model, and extensive literature is available in market microstructure arguing both the positive and negative long-term impacts of indexes. Subrahmanyam (1991), for example, demonstrated that a basket product increases the liquidity of the basket but decreases the liquidity of the underlying stocks. Gorton and Pennacchi (1993) showed in their model that index securities reduce uninformed losses to informed traders—and correspondingly reduce the incentives for informed traders to become informed (see Baruch and Zhang 2018; Cong and Xu 2019; and Bond and Garcia 2019 for more contemporary views). Moreover, the evolution of ETFs into ever more specialized index-linked products has increasingly turned what were once "passive" products into the building blocks of very active portfolios. Easley, Michayluk, O'Hara, and Putniņš (2018) presented empirical evidence that these uses of ETFs are not resulting in less active markets and that prices are not less informative. So the informational concern regarding ETFs seems overblown. That does not mean, however, that ETFs do not have other important effects on the market.

[9]See, for example, Inigo Fraser-Jenkins, "The Silent Road to Serfdom: Why Passive Investing Is Worse than Marxism," Sanford-Bernstein Research Report (23 August 2016). See also Burton G. Malkiel, "Is Indexing Worse than Marxism?" Wealthfront Corporation (21 November 2016). https://blog.wealthfront.com/indexing-worse-than-marxism.

5. CAN ETFs DISRUPT MARKETS?

ETFs have demonstrable effects in a wide variety of asset classes—from equities (Ben-David, Franzoni, and Moussawi 2018) to bonds (Pan and Zeng 2019), commodities (Corbet and Twomey 2014), and currencies (Marshall, Nguyen, and Visaltanachoti 2018). So the effects of ETFs do not seem tied to particular idiosyncrasies of special asset classes. In evaluating the influence of ETFs, what appears to matter is whether the instrument has crossed a certain activity threshold in the asset market of interest. Though the first US ETF was launched in 1993, ETFs remained a relative sideshow for asset markets till the financial crisis in 2008. The larger effects of ETFs have become pronounced only recently, after trading in these instruments became a sizable fraction of the underlying asset trading in many markets. ETFs become a significant player in a market in three ways.

First, ETFs create impacts when access to the particular underlying asset or market is restricted—for example, bonds traded in OTC markets or foreign equities bought and sold primarily in their home countries. Basic asset pricing theory recommends that investors hold a well-diversified market portfolio, but the point that is frequently overlooked is that the "market" in this market portfolio refers not just to liquid home country equities but to all tradable assets in all asset classes in all available markets. Whenever an ETF brings access to a market that was hitherto inaccessible to a large segment of investors, this almost mechanical diversification effect creates an influx of liquidity into the ETF, often pushing its popularity above the threshold that leads to market effects. Given the low interest rate regime that has prevailed since the great recession in 2008, ETFs on risky, restricted

assets have become an especially attractive destination for investor money.

Second, ETFs affect markets when a panic leads to a sudden flight of capital in an otherwise liquid market. We have witnessed such incidents time and again—for instance, during the "taper tantrum" in bond markets in the summer of 2013 and on 24 August 2015, when the Dow witnessed its largest intraday decline in history. Even though the volumes in markets such as large-cap equities and bonds are substantial, at such times, the demand for buying and selling in the ETFs rises considerably while underlying markets are frozen and difficult to trade. Thus, at least momentarily, trading in ETFs becomes a significant fraction of the overall market trading.

Third, ETFs influence markets as part of the broad move toward passive investment in markets. Morningstar has estimated that 48% of all US stocks were held by passive index-tracking funds in December 2018, and by July 2019, this number crossed the 50% mark.[10] BlackRock reports that total global exchange-traded product assets reached approximately US$5 trillion across asset classes in October 2018.[11] Increasingly, in many markets, active trading is giving way to passive investment in instruments such as ETFs.

These features of modern ETFs speak to their systemic importance in markets but not necessarily to their role in instigating systemic risks. To evaluate this role, we consider more carefully some specific avenues where risk may arise.

A. Does Concentration Pose Risks?

One feature of the present ETF market structure is the severe market concentration at various levels of the ETF food chain. Most ETF categories are dominated by two or three big issuers, and many issuers in turn depend on a handful of authorized participants. Especially in illiquid markets, such authorized participants are often also the market makers in the underlying. Given the growing importance of ETFs in the ecosystem, such concentration could become a source of risk for the wider markets.

How the dominance of a few ETF issuers affects the market is a question relatively unexplored in the literature. Over three-quarters of all ETF activity in the United States is handled by the top three issuers—BlackRock's iShares, State Street's SPDR, and Vanguard—and even when one segments the market using various criteria, the dominance of a handful of players in each category stands out.[12] Such a top-heavy market structure is usually indicative of strong network effects. Yet ETFs in principle are fairly standard, substitutable, low-cost products. So the reason more issuers are unable to penetrate the market is not completely clear. Certainly, the intense fee competition that has emerged among issues suggests that the ETF market is highly competitive.

To date, we have no direct empirical evidence of issuer concentration in ETFs being the cause of market instability in the United States. Concerns have been raised, however, with respect to ETNs. ETNs are issued by financial institutions and are unsecured debt obligations linked to the return of a market index. Whereas ETFs own the underlying securities, ETNs are more like return swaps tied to a particular index. The return to the investor depends on both the performance

[10]Charles Stein, "Shift from Active to Passive Approaches Tipping Point in 2019," Bloomberg (31 December 2018). www.bloomberg.com/news/articles/2018-12-31/shift-from-active-to-passive-approaches-tipping-point-in-2019.

[11]Cited in SEC Subcommittee on ETFs and Bond Funds (2019).

[12]"ETF Directory," ETFdb.com. https://etfdb.com/etfs/.

of the index and the credit risk associated with the issuer. Cserna, Levy, and Weiner (2013) estimated the credit risk inherent in such products and found that it is substantial and not reflected in ETN market prices. Their study focused on four of the largest issuers of ETNs—Barclays, Deutsche Bank, Morgan Stanley, and UBS—highlighting that concentration risk may indeed be an issue in this corner of the market. Clearly, more research is needed to evaluate the importance of this risk and its impact on the market.

Some important unsettled questions in the literature involve the investor clientele of ETFs. Are ETFs bringing in new participants that would not otherwise have invested in other passive instruments, or are ETFs just a beneficiary of a broader trend toward passive instruments? Are ETFs cannibalizing clients from other index products or from the underlying asset markets? Such questions are tricky to answer because the precise counterfactuals are difficult to address and data are not easily obtained, but they matter in terms of gauging the ETF markets' potential impact.

Dannhauser (2017) presented evidence that fixed-income ETFs reduce the proportion of retail trading and increase institutional ownership of the underlying bonds. Is this shift a matter of concern? Nam (2017) suggested not, finding that underlying bond liquidity generally improves for a variety of bond types after bond ETFs are introduced. Huang, O'Hara, and Zhong (2018) investigated the role of hedge funds and their extensive use of industry ETFs. These authors showed that industry ETFs have large, often remarkably large (i.e., greater than 100%), short interest, an effect they argued is due to hedge funds implementing a "long the stock, short the industry" ETF strategy. They provided evidence that this use of ETFs is actually positive for the market because it increases informational efficiency.

Some evidence, however, raises concerns about potential risks arising from clientele concentration. For the past 10 years, the Bank of Japan (BOJ) has been buying ETFs as part of its monetary policy program. This sustained buying has resulted in the BOJ now holding approximately 80% of Japanese ETF equity assets.[13] The BOJ is also a top-10 shareholder of 40% of listed Nikkei companies. Charoenwong, Morck, and Wiwattanakantang (2019) found that the BOJ's purchases of ETFs increased stock prices. Hanaeda and Serita (2017) found that larger holdings of ETFs increase market volatilities and induce more positive serial correlations between these volatilities. Of course, the interests of the BOJ would surely include market stability, but changes in monetary policy affecting ETF holdings, or even the fear of such changes, could be an impetus for non-BOJ ETF holders to flee, inducing the herding effects noted earlier.

B. Can Authorized Participant Activity Be a Source of Risk?

The aftermath of the 2008 financial crisis taught us the important lesson that intermediary balance sheets matter for asset prices, especially in times of stress. When ETFs are issued on hard-to-trade illiquid assets, authorized participants often have difficulty presenting the entire basket of underlying assets to the issuer during creation/redemption. In such cases, only a subset of the basket might change hands on the issuance of new ETF shares.[14] Which assets

[13]See Andrew Whiffin, "BoJ's Dominance over ETFs Raises Concern on Distorting Influence," *Financial Times* (21 March 2019). www.ft.com/content/aba02f8c-3eab-11e9-9499-290979c9807a.

[14]A useful summary of the regulatory framework for clearing and settlement in ETFs is presented in Rochelle Antoniewicz and Jane Heinrichs, "Understanding Exchange-Traded Funds: How ETFs Work," *ICI Research Perspective* 20, no. 5 (September 2014): 1–39.

are actually exchanged depends on the bespoke contracts between authorized participant and issuer. Such transactions introduce a tracking error risk into issuer and authorized participant balance sheets. The extent of this risk in the system, how it is managed and offloaded, remains unexplored in the literature.

A particularly important aspect of this authorized participant risk is "step away" risk—the possibility that in times of market stress, authorized participants may scale back or even step away entirely (see SEC Subcommittee on ETFs and Bond Funds 2019 for more discussion). In their dataset on corporate bond ETFs, Pan and Zeng (2019) revealed that the mixed incentives resulting from the dual role of authorized participants—as dealers in the underlying markets and as ETF authorized participants—can have a significant effect on arbitrage activity: "[A] one-standard deviation increase in bond market illiquidity generates a 10–40% decline in AP [authorized participant] arbitrage sensitivity" (p. 4). Earlier literature in the industry suggested that the average number of authorized participants was at least 30 in most categories, in which case, such dual-role risks are minimal.[15] But authorized participants are not required to undertake creation/redemption activity, and the results in Pan and Zeng (2019) suggest that deviations from this average may occur in particular illiquid markets.

One reason this "step away" risk can take on systemic importance is that it affects money managers holding ETFs in other types of funds. The rise of fixed-income ETFs has led many asset managers to use ETFs for cash management purposes.[16] This practice of using ETFs as cash equivalents is only appropriate, however, if the ETFs can always be turned into cash immediately (and relatively without cost). Disruptions in the bond market, leading to disruptions in the creation and redemption process for fixed-income ETFs, would undermine this ability. The European Systemic Risk Board has argued that such disruption could destabilize institutions that depend on ETFs for cash management. The Central Bank of Ireland, as part of a broader program to manage potential concentration risk, has proposed identifying which institutions act as authorized participants and how they are compensated for doing so.[17]

C. Do ETFs Introduce Added Risk during Periods of Market Stress?

To date, the bulk of the empirical academic literature has studied the broad impact of ETFs on market quality, and few studies have looked into specific episodes of market disruption. A notable exception is the work of Dannhauser and Hoseinzade (2017), which examined the effect of ETF flows on bond spreads during the taper tantrum, discussed in Section 2 of this paper. These authors found that the outflows in ETF bond funds seem to have significantly exacerbated bond yield spreads. Saglam, Tuzun, and Wermers (2019) included a discussion of liquidation costs around the US debt-ceiling crisis of 2011—when the US Congress struggled to raise

[15]Rochelle Antoniewicz and Jane Heinrichs, "The Role and Activities of Authorized Participants of Exchange-Traded Funds," Investment Company Institute (March 2015). www.ici.org/pdf/ppr_15_aps_etfs.pdf.

[16]See Rachel Evans and Emily Barrett, "Fund Blowups Rekindle Doubts about ETF Liquidity in Crisis Times," Bloomberg (12 July 2019). www.bloomberg.com/news/articles/2019-07-12/panic-sales-rekindle-debate-over-etf-liquidity-in-next-crisis.

[17]See "Exchange Traded Funds," Central Bank of Ireland discussion paper (2017). Available at www.centralbank.ie/docs/default-source/publications/discussion-papers/discussion-paper-6/discussion-paper-6---exchange-traded-funds.pdf.

the debt ceiling and Standard & Poor's subsequently downgraded the US credit rating. This downgrade led to high volatility in markets and large outflows. Saglam et al. found that stocks with high ETF ownership faced additional liquidity pressure during this crisis.

At a certain level, the limited number of academic studies on specific episodes of disruption reflects the paucity of data. To make careful inferences about the behavior of ETFs, one needs data not only on publicly traded prices but also on instrument-specific factors, such as the indicative NAV and granular authorized participation trading activity, and these are difficult to obtain. In fact, when the underlying assets are not traded on an exchange, even basic asset prices are rarely available. Hopefully, as regulators become more sensitive to the disruption risks, more data on important episodes will be collected and made available in the public domain. For now, the evidence is consistent with ETF behavior exacerbating market volatility in stressful times.

An equally interesting issue is whether ETFs impose additional stress on markets even during normal times. A case in point is end-of-day trading. The percentage of trades occurring in the final hour of the trading day, and often in the final minutes, has been steadily increasing—moving, for example, from 17% of NYSE trading in 2012 to 26% in 2018. One reason for this increase is tracking error. Managers of index-linked funds need to keep their positions in line with the index, and they minimize their tracking error by trading at the end of the day.

Leveraged ETFs are a prime example. These products promise investors a multiple (say, 2×, 3×, or even the inverse) of the return on an underlying index, with leverage responsible for generating this extra return. To pursue this strategy, leveraged ETFs rebalance at the end of the day, buying when prices go up, and increasingly so, given the magnitude of the market return. Cheng and Madhavan (2010) asserted that these rebalancing flows have increased volatility near the close of trading. Bessembinder (2015) argued, however, that this need not be the case, given that predictable flows (such as those linked by a functional rule to price moves) should have only temporary price effects. Moreover, he noted that fund managers often use derivative positions (such as index return swaps) to meet their exposure needs, obviating their need to trade in the actual stock market at the end of the day. Of course, the writer of the swap may have to offset its position in the stock market, so the overall effect is unclear.

Whether particular investment products are responsible for the increasing concentration of trade at the end of the day is debatable. But what is less arguable is that disruptions at the end of the day are more detrimental to the market than at other times because of the lack of time in which to attract counterparties to offset imbalances. In this sense, even temporary price effects may have long-lasting effects if the markets close before adjustments can occur. From a regulatory perspective, some ETF products may simply impose too great a risk of such effects—in essence, their dodgy driving is not consistent with the safe operation of the financial motorway.

6. REGULATORY RESPONSE

Repeated disruptions have made regulators anxious about the new landscape with ETFs, but the nature of the optimal regulatory response is still a matter of debate. Regulators have a range of tools at their disposal, and in this section, we discuss some of them.

A. Circuit Breakers and Limits

Circuit breakers are found in many market settings and were introduced in US equity markets in the aftermath of the Black Monday crash in 1987. These rules halt trading in assets when dramatic price swings occur, the intuitive idea being that a pause might help market participants regain composure after a panic and provide time to attract counterparties willing to step up and buy. The original circuit breakers used a static reference price. For example, a 7% drop in price relative to the previous day's close might lead to a 15-minute halt in trading. Static references were found lacking during the flash crash on 6 May 2010, which saw the Dow lose over 9% of its value in less than 10 minutes. In response, regulators introduced dynamic reference prices through limit up and limit down rules. For these rules, the reference is usually the average price over the previous five minutes of trading, and securities, including ETFs, are classified into various tiers. The price limits around the reference depend on the tier to which a security belongs, and if a trade tries to breach the limit, a pause is triggered.

Although the evidence is anecdotal, the prevalent limit up and limit down rules are widely blamed for having exacerbated the market problems on 24 August 2015, our first example in Section 2.[18] More than 1,100 halts occurred in ETFs in a matter of a few minutes that day as prices moved from one limit to another because of huge selling pressure. The problems here arose not only from trading in the underlying stocks but also from trading in the ETFs. In response, the SEC tweaked the limit rules further in its Amendment 10 (Hughes 2017).

The academic view of circuit breakers is mixed, though little work is available on the new limit up and limit down rules. Subrahmanyam (1994) showed that traditional, static reference circuit breaker rules might cause agents to suboptimally advance their trades in time, increasing price variability and exacerbating price movements. In a certain sense, circuit breakers and limits are last-mile responses: Unless well designed and precisely targeted, they can cause collateral damage.

For ETFs on underlying asset markets that are ordinarily easy to buy and sell but are afflicted by sudden bouts of illiquidity from time to time, circuit breakers might be a useful tool, if properly implemented. In particular, circuit breakers could be designed to kick in when underlying illiquidity threatens to generate a herding spiral. As the liquidity situation eases, normal trading can be allowed to resume. Because the crucial variable for herding is the systematic factor, a function of the ratio of an asset's idiosyncratic factor to systematic factor value in price might serve as a useful reference for a circuit breaker. For underlying markets that are chronically illiquid, however, regulators might be better served by addressing the root issues that lead to disruptions.

B. Underlying Market Quality

In a recent research report, Moody's warned that ETF liquidity mirrors underlying market liquidity during bursts of market volatility.[19] The reason for this effect is not hard to fathom. ETF portfolios need to be rebalanced

[18]Bob Pisani, "What Happened during the Aug 24 'Flash Crash,'" Trader Talk, CNBC (25 September 2015). www.cnbc.com/2015/09/25/what-happened-during-the-aug-24-flash-crash.html.

[19]Fadi Abdel Massih and Ana Arsov, "ETFs Ability to Weather Liquidity Risk Governed by Its Underlying Market," Research Announcement, Moody's Investors Service (9 May 2019). www.moodys.com/research/Moodys-ETFs-ability-to-weather-liquidity-risk-governed-by-its--PBC_1174986.

periodically, and unless underlying markets have sufficient liquidity, they cannot absorb the rebalancing trade flow. As ETFs become commonplace in illiquid asset categories, this illiquidity risk grows—as does its potential to lead to more systemic market-wide effects. ETFs based on leveraged loans are a case in point. Leveraged loans are bank loans, often created in the context of takeover activity. The *Financial Times* describes these loans as "opaque, nonpublic and illiquid, with idiosyncratic contract terms."[20] Indeed, a remarkable feature of this underlying market is that the settlement of trades can take 20 days or more! Little wonder, then, that a variety of observers have questioned whether leveraged loans may simply be too illiquid to support the demands of such an ETF product.[21]

The SEC promulgated Rule 22e-4 in October 2016 to address concerns about liquidity in mutual funds and ETFs. The rule requires that funds classify underlying holdings into liquidity categories and restricts funds from holding more than 15% exposure to illiquid holdings. An ETF can be exempted from these requirements if the ETF redeems in kind, but it must meet other requirements related to liquidity when assessing, managing, and reviewing liquidity risk.[22]

Our analysis suggests that the overall quality of the underlying market also needs to be sufficiently robust for the ETF mechanism to function well. Underlying markets need to be transparent, prices need to be readily available, counterparties need to be easily accessible, volumes need to be sufficiently high, and so on—in other words, all the usual requirements for a healthy, functioning market need to be satisfied if we are to avoid the kinds of disruption featured in Section 2.

Thus, improvements such as enhanced transparency of individual bond prices through real-time trade reporting to the Trade Reporting and Compliance Engine (TRACE) are beneficial. The growing electronic trading of bonds and alternative investments will provide greater transparency of order information as well as greater accessibility, which can serve to dampen ETF-related market instability. In a similar vein, greater accuracy of NAVs can reduce uncertainty and unnecessary arbitrage activity, both of which can induce excessive volatility in ETF (and underlying) prices. Yet, as we discuss in the concluding section, even these seemingly straightforward market properties are not without controversy.

7. RECAP OF RESULTS AND RECOMMENDATIONS

Can ETFs be a source of systemic risk in the markets? Our analysis suggests that they can. Specifically, the empirical evidence indicates the following:

1. ETFs appear to amplify market movements during periods of stress and uncertainty, reflecting the impact of feedback trading from ETF markets to the underlying markets and vice versa.

2. ETFs also appear to exacerbate end-of-day volatility during normal times, likely because

[20]Alexandra Scaggs, "Please Don't Tell Individual Investors to Buy Leveraged Loans," *Financial Times* (23 May 2018). https://ftalphaville.ft.com/2018/05/23/1527078420000/Please-don-t-tell-individual-investors-to-buy-leveraged-loans/.

[21]See, for example, Matthew Blume, "Don't Lose Your Trunks with Leveraged Loan ETFs," NASDAQ (8 March 2019). www.nasdaq.com/article/dont-lose-your-trunks-with-leveraged-loan-etfs-cm1111561.

[22]See SEC Subcommittee on ETFs and Bond Funds (2019) for a discussion of these issues. See also SEC, "Investment Company Liquidity Disclosure," Release No. IC-33046 (2018). www.sec.gov/rules/proposed/2018/ic-33046.pdf.

of the need to rebalance some ETF types and potentially to track error-based trading.

3. "Step away" risk on the part of authorized participants is a concern, with some evidence of reduced authorized participant activity in stressful periods. This issue is especially serious in illiquid markets, where authorized participants are often also the dealers in the underlying markets.

4. The use of ETFs as cash substitutes by money market funds and other investment products raises the prospect of problems in ETFs spreading to other markets.

5. ETFs based on illiquid, nontransparent markets can face rebalancing risks, which can lead to systemic effects on both the ETF and the underlying.

What implications do these findings have for regulators? We suggest the following:

1. The potential for feedback trading requires renewed attention to circuit breakers and rules relating to trading halts. At present, ETFs are treated like ordinary securities for the purposes of circuit breakers. However, given the potential for feedback trading, the efficacy of trading halts might be enhanced if the operation of circuit breakers in ETFs were coordinated with the operation of circuit breakers in the underlying.

2. The potential for disruption of end-of-day trading needs to be examined. Changes to market closing mechanisms and restrictions on (or even the prohibition of) certain types of ETFs should be considered to avoid end-of-day disruptions.

3. More information is needed on the activities of authorized participants in the creation and redemption process. Issues such as participation rates, liquidity, and capital needs should be addressed, as well as any cross-sectional differences among ETF asset class categories. Regulators should attempt to estimate the potential "step away" risk and how it is affected by volatility and other market parameters. Does the "step away" risk differ for fixed-income ETFs? Is it more of a problem for ETFs based on emerging market asset classes?

4. The role of the intraday NAV and its dissemination should be considered. Should the NAV be part of the consolidated tape, or can it be made readily available to traders in another way? How frequently should the NAV be updated?

5. Given the proliferation of new ETF forms, are the SEC's current liquidity rule exemptions for ETFs still appropriate?

6. Understanding how widely ETFs are now being used as cash substitutes would be very useful. Is sufficient regulatory reporting in place to determine the extent of this practice, and if not, how might reporting requirements be changed to give regulators this information?

7. More regulatory focus is needed on the collection and dissemination of information about underlying markets in which ETFs represent a significant fraction of trading. This issue is especially important for a hard-to-access underlying and pertains to trade reporting as well as fundamental information. Should we require the quality of information in underlying markets to meet some minimum standards before ETFs are approved?

8. Regulators might also want to reexamine some of the basic provisions of the ETF structure. For instance, attempts at fresh creations or redemptions during periods

of uncertainty seem to exacerbate trading upheaval. Would doing away with this provision when markets are stressed be helpful?

8. CONCLUDING THOUGHTS

In terms of impact, ETFs easily rank as one of the most important financial innovations of recent times (Lettau and Madhavan 2018). We cannot deny that ETFs have made investing in markets much simpler and cheaper. For many investors, they have opened up new asset classes that formerly permitted only privileged entry, helping to create better, more well-diversified personal portfolios in the process. In certain ways, the challenge with ETFs is similar to the challenge with giant social networks. Arguing against the many benefits that social networks have brought to individuals is difficult, but at the same time, given the scale of the Facebooks of the world, wishing the systemic impacts away is no longer possible.

In the case of ETFs, one set of systemic effects arises from their passive, basket structure. The long-term effects of the erosion of active, asset-level investing that passive instruments such as ETFs have engendered are slowly unfolding in the markets. A second set of systemic issues concerns the role of ETFs in market disruptions. In recent years, the frequency, suddenness, and ferocity of such disruptions have surprised both regulators and market participants.

Do we have the right "rules of the road" for this new market structure? For the most part, the answer seems to be yes, but as with any evolving market structure, the big problem is that "we don't know what we don't know." As we have discussed in this paper, some issues seem clear. The SEC's new liquidity rules are one attempt to address the challenges posed by fund redemptions accompanying market disruptions. The Bank of Ireland's focus on authorized participant concentration disclosure seems well placed, given the increasing scale of the creation/redemption process. The SEC has also recently turned down requests for cryptocurrency-based ETFs, arguing that the underlying markets are not sufficiently mature.

Yet controversy reigns with respect to other regulatory issues, highlighting the conflicting forces at work in regulating markets. Bond dealers are pressuring the SEC to allow for delayed reporting of large bond trades, arguing that real-time reporting increases price impacts for large trades. The growing role of bond ETFs, however, would argue against reducing price transparency, particularly given that as of 2017 block trades still constituted almost 60% of trading volume in investment-grade bonds. How, then, to balance concerns about price impacts with fears of potential ETF-related market disruptions?

The SEC has recently proposed abolishing the practice of ETFs updating NAVs every 15 seconds, agreeing with industry arguments that NAV estimates are often inaccurate and unreliable—and particularly so during volatile times. While firms would use internal models to estimate NAVs, does leaving the market in the dark about such values place some traders at a disadvantage or, worse, lead to herding out of the market when problems arise?

Moving in a seemingly opposite direction, in April 2019, the SEC voted to allow Precidian Funds to offer actively managed ETFs that do not provide daily transparency into the portfolio's holdings.[23] Precidian argued that such an innovation was needed to keep others from freeriding on the ETF manager's selection

[23]Lizzy Gurdus, "The First Confidential, Actively Managed ETF Just Got SEC Approval. Here's How It Works," CNBC (15 June 2019). www.cnbc.com/2019/06/15/the-first-non-transparent-etf-gets-sec-approval-heres-how-it-works.html.

ability. To ensure the efficiency of the ETF arbitrage mechanism, the SEC will require that the Precidian ETF be composed only of assets that trade actively on exchanges. In addition, independent agents will value the ETF's portfolio (and report that value) every second at the midpoint of the current national best bid or offer for the underlying securities. But is revealing the fund's holdings only a few times a year consistent with the function of an ETF? And is actually concealing the fund's holdings even possible when second-by-second price updates may allow savvy participants to reverse-engineer the product's composition? Whatever the answers to these questions, the evolution of ETFs is far from over.

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