

ETF shares as shadow money: A short inquiry into the assetization and moneyness of the corporate bond ETFs

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Abstract

Exchange-Traded Funds (ETFs) have revolutionized the asset management industry with their ability to generate market liquidity in fundamentally illiquid markets, such as the over-the-counter (OTC), dealer-intermediated corporate bonds market. ETFs were created through the assetization process, which gave the index an exchange value or revenue-generating ability. As the ETFs are now at the forefront of the market-based finance, the focus will be on positioning ETF shares in the hierarchy of money and how this amounted to a new form of shadow money. This positioning in the hierarchy of money allows us to analyze the moneyness of corporate bond ETF shares. This analysis is crucial because Covid-19 pandemic crisis revealed that many corporate bond ETFs traded at all-time high discounts between the shares price and Net Asset Value (NAV). As such, this paper aims to demonstrate the three main causes behind this moneyness dysfunction, (a) the malfunctioning of the arbitrage mechanism during significant sell-offs, (b) the inventory management practices of certain 'authorized participants', and (c) the liquidity mismatches. This moneyness dysfunction was only alleviated when the Federal Reserve expanded its innovative post-crisis instruments and began purchasing ETF shares. This highlights the increasing relevance of this novel form of shadow money in the post-crisis era.

Keywords: exchange-traded funds, moneyness, assetization, asset management, Federal Reserve.

JEL Classification: E40, E44, E52, E58, G23

Introduction

Since the Global Financial Crisis of 2007-2009 (GFC), asset managers have emerged as dominant players in financial markets (Kay, 2012), marking the definitive arrival of the "age of asset management" (Haldane, 2014: 2). This evolution of asset management began in the 1970s but gained momentum with the regulatory changes imposed by the Financial Stability Board (2015). These changes aimed to curb the so-called 'toxic' shadow banking activities and facilitate a shift towards collective investment schemes. However, in the post-crisis era, it is not asset management as a whole that has grown significantly, but rather passive management. Passive management primarily involves replicating market indices, such as the S&P500, with considerably lower costs. The key institutions driving this

index-based approach are Exchange-Traded Funds (ETFs) and index funds. The rise of passive management has profound implications for corporate power (Jahnke, 2019), which is closely tied to the 'delegation' of investment decisions. In other words, passive management relies on delegating investment choices to index providers (Petry et al., 2019). Index providers hold significant influence over financial flows through the decisions they make. However, the importance of the index business extends beyond facilitating the listing of ETFs on exchange-run trading platforms (Petry, 2020); it also involves the creation of these ETFs.

The creation of ETFs relies on a process called assetization, which involves assigning exchange value to things that previously held only use-value. While the existing literature has predominantly focused on assetization within the context of real estate (Wu et al., 2020; Christophers, 2021; Stirling et al., 2023), this paper contends that assetization has evolved to encompass the creation of novel and dynamic asset forms that are accessible to institutional cash pools, including ETF shares.

Therefore, we argue that assetization has given rise to ETFs, which stand as one of the main financial innovations of recent decades. This paper aims to delve into the analysis of corporate bond ETFs, a distinct component compared to equity ETFs, but one that experiences more significant changes in liquidity conditions. ETFs are widely acknowledged for their inherent ability to generate market liquidity - the ease with which an asset can be traded (Brunnermeier & Pedersen, 2009) - due to higher trading volumes and tighter spreads compared to the underlying securities market, particularly the OTC corporate bond market. The evolution of ETFs underscores their significance in market-based finance. Given the increasing relevance of this financial instrument, the primary focus of this paper is to position ETF shares within the hierarchy of money. Consequently, the initial objective is to analyze ETF shares from the perspective of shadow money literature. Shadow money refers to private credit instruments that functionally resemble traditional forms of money (Murau & Pforr, 2020), acting as substitutes for commercial bank deposits (Ricks, 2011). The literature exploring shadow money has flourished in recent years with numerous authors examining their role within the shadow banking system (Gorton & Metrick, 2012; Adrian, 2014; Pozsar, 2014; Murau, 2018). The evolving nature of the shadow banking system, with its capacity to generate new manifestations of shadow money over time (see Murau & Pforr, 2020), leads this paper to assert that ETF shares should also be acknowledged as a form of shadow money. This assertion is particularly relevant given the increasing significance of asset management in contemporary times (see Braun, 2016).

The positioning of ETF shares within the hierarchy of money confers upon them a distinct moneyiness and systemic significance as private credit instruments. Recognizing ETF shares as a form of shadow money and acknowledging their systemic significance, this paper further aims to investigate the moneyiness of these instruments. Therefore, it specifically examines the moneyiness of corporate bond ETFs during the Covid-19 crisis. While some studies highlight the resilience of these ETFs during the pandemic crisis (ICI, 2020; Blackrock, 2022), this paper contends that the moneyiness of corporate bond ETFs has been significantly affected. Three factors that have impacted the moneyiness of these instruments are identified in this paper: (a) the malfunctioning of the arbitrage mechanism during significant sell-offs, (b) the inventory management practices of certain 'authorized participants', and (c) the liquidity mismatches.

The novelty of this paper lies in making a case for including ETF shares as a form of shadow money within the hierarchy of money, as well as analyzing the moneyiness of corporate bond ETFs during the pandemic crisis. Examining the moneyiness of these instruments will provide insights into the reasons behind their deviation during this period of distress and shed light on the role played by the Federal Reserve (Fed) in stabilizing this market, thereby highlighting once again the central bank's role as a dealer of last resort in recent years (Mehrling, 2011). By analyzing the moneyiness of this innovative

form of shadow money, this paper has implications for financial stability and the implementation of monetary policy in the era of market-based finance.

For empirical analysis, this paper uses the Covid-19 crisis as a case study. To ensure empirical relevance, methodological triangulation is employed, incorporating primary, secondary, and tertiary sources. Primary sources consist of research papers from supranational financial institutions (e.g. International Monetary Fund) and press articles from reputable financial newspapers (e.g. Reuters and Bloomberg). Secondary sources encompass papers and books specific to the analyzed topic. Tertiary sources involve quantitative data that complement the primary and secondary sources, such as statistics on the Secondary Market Corporate Credit Facility (SMCCF).

The paper is structured into six subchapters. The first subchapter provides a brief overview of the shadow money literature and the assetization process. The second subchapter presents a theoretical examination and a concise comparison between ETFs and index funds. The third subchapter incorporates ETF shares into the shadow money literature and elucidates the concept of moneyiness. The fourth subchapter conducts an empirical analysis of the factors that affected the moneyiness of corporate bond ETFs during the Covid-19 pandemic crisis. The fifth subchapter examines the role of the Fed in supporting the ETF market. Finally, the last subchapter presents the conclusion of the paper.

1. From shadow banking to market-based finance. A short overview of assetization

There is a broad consensus that the GFC was caused by the shadow banking system. The Financial Stability Board (FSB) was the first institution to provide a definition of this system, characterizing it as “credit intermediation involving entities and activities outside the regular banking system” (FSB, 2011: 1). This credit intermediation occurs through a wide array of financial institutions, including private equity firms, hedge funds, money market funds (MMFs), and special purpose vehicles (see Pozsar, 2014). Together, these institutions form a structure for liquidity intermediation. Liquidity is brokered between cash-rich financial entities, such as MMFs, and security-rich institutions, such as hedge funds. This intermediation primarily occurs through the use of shadow liabilities or shadow money, which possess varying degrees of moneyiness (Bonizzi & Kaltenbrunner, 2020).

In the literature, several theories attempt to define shadow money. One theory, proposed by Mitchell (2017), argues that shadow banks cannot effectively contribute to money creation. Another theory, put forward by Gabor and Vestergaard (2016), asserts that only repurchase agreements (repos) can be considered a form of shadow money due to their collateralization. However, in contrast to these theories, Morgan Ricks (2011) and Zoltan Pozsar (2014) adopt a broader perspective on shadow money. This paper aligns with their approach, recognizing that various forms of shadow money have emerged since the 1970s. Examples include asset-backed commercial papers (ABCPs), MMFs, overnight repos (O/N repos), and foreign exchange swaps (FX swaps), which serve as wholesale money market instruments. Consequently, this paper focuses on introducing ETF shares into the hierarchy of money, analyzing the criteria that determine an instrument’s status as shadow money.

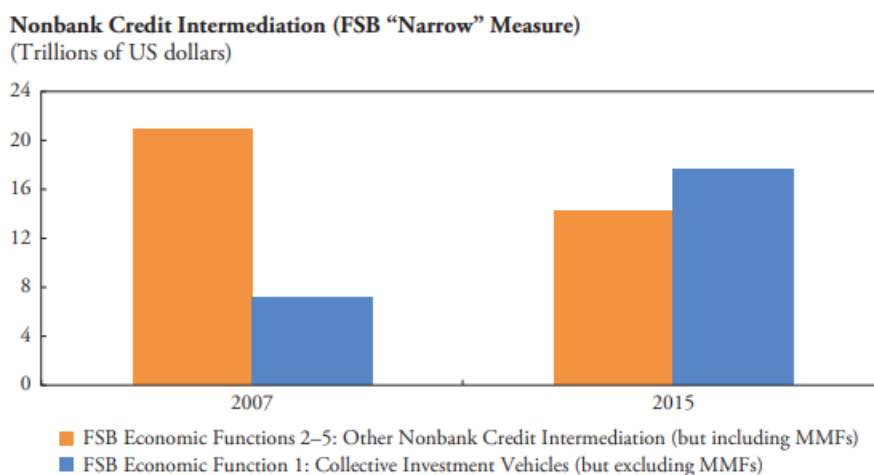
As indicated, the shadow banking system enables financial institutions to fund transactions in capital markets via money markets, using shadow money. Therefore, this system can also be described as a “money market funding of capital markets” (Mehrling et al., 2013: 2). Furthermore, within the realm of the shadow banking system, a continuous process of financial innovation has taken place, giving rise to the aforementioned forms of shadow money, as well as novel structured products. Securitization and assetization are two such processes that have facilitated financial innovation, serving the purpose of expanding the availability of safe assets (Gabor & Vestergaard, 2016), as well as enabling leverage

(Sgambati, 2016). Securitization is the process of bundling, segmentation, whereby non-tradable assets (i.e. mortgages) become liquid and tradable (Gorton & Metrick, 2012). These structured products are created using shadow money. For instance, ABCPs were issued by special investment vehicles (SIVs) that were then actively involved in the aforementioned bundling process. These instruments were significantly affected during the GFC.

However, despite the loss of moneyness experienced by various forms of shadow money during the GFC, such as ABCPs (Murau, 2017), we have witnessed the emergence of new shadow instruments, including ETF shares, as we will argue. Otherwise put, there has been a post-crisis shift in the shadow banking sector towards what is now referred to as market-based finance. This is defined as “the system of markets, non-bank financial institutions and infrastructure which, alongside banks, provide financial services to support the wider economy” (BoE, 2021: 3). This transformation was initiated by the Financial Stability Board (2015), which aimed to enhance the resilience of the shadow banking system by implementing stricter regulations on securities lending and collateral frameworks.

This shift resulted in a general trend of “flight to simplicity and transparency” (Adrian & Jones, 2018: 11), moving away from the ‘opaque’ shadow activities that contributed to the magnitude of the GFC. Market-based finance has thus evolved into what is now known as the ‘age of asset management’, where asset managers play a more prominent role in the global financial system while engaging in fewer risky shadow banking practices (Adrian & Jones, 2018). Consequently, new financial intermediation chains with reduced interconnectivity have been established, accompanied by a significant increase in the number of collective investment vehicles. These collective investment vehicles now constitute 60 percent of the entire shadow banking sector, surpassing the size and growth rate of securitization (Adrian & Jones, 2018). As a result, collective investment vehicles have gained a much more crucial role in global non-bank credit intermediation compared to other non-bank credit intermediation institutions, as evidenced by figure 1.

Figure 1. Non-bank Credit Intermediation post-crisis



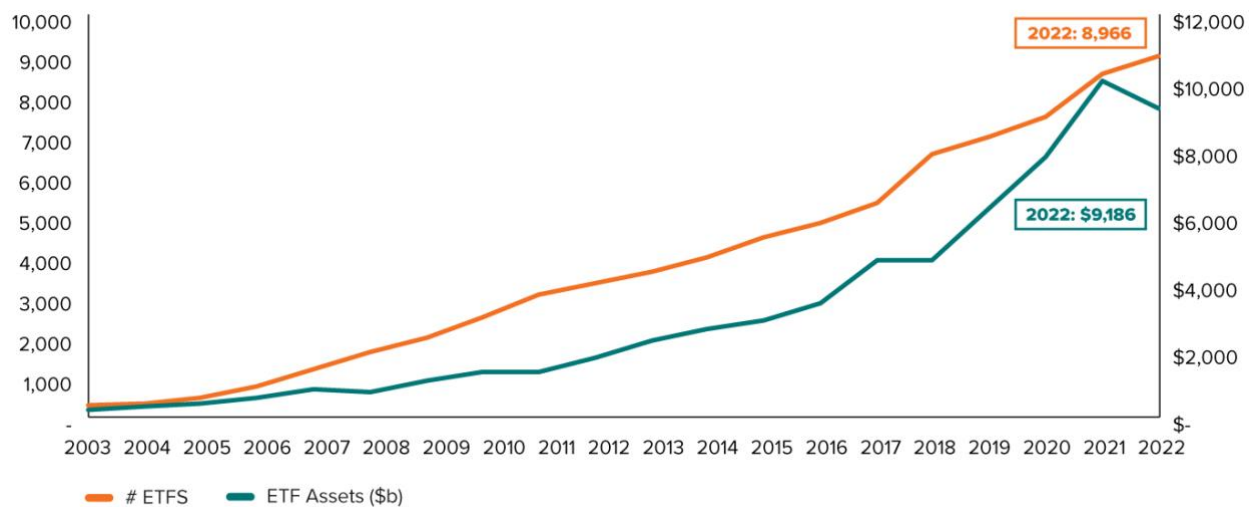
Source: Adrian & Jones 2018

The second mechanism at play is assetization, which underlies the emergence of ETFs. As a brief definition, the concept of assetization points to contingent processes which turn all manner of things into assets (Langley, 2020). Unlike securitization, assetization differs in the slicing and bundling process. Securitization involves bundling a debt and selling it to institutional investors who are primarily

interested in the specific “bit of material asset” (Sassen, 2012: 79) within the structured product. On the other hand, assetization entails the conversion of a portfolio with a specific composition into a tradable investment product. The aim of assetization is not to segment the portfolio into multiple parts but rather to treat the portfolio as a single revenue-generating asset (Birch, 2015). In essence, this mechanism generates and extracts a continuous stream of revenue (or exchange value) from non-tradable assets that previously had only use-value.

In the case of ETFs, assetization is the process of transforming an index portfolio with a specific composition into an effective and tradable investment product. An index itself is a non-tradable product for economic agents or firms without a direct exposure to that index. It only holds use-value as it serves as a numerical representation of the performance of the stocks or bonds comprising the index (Petry et al., 2019). Only through the process of assetization, this index also obtains a revenue-generating ability. ETFs are widely recognized as one of the most significant financial innovations in recent years. They act as liquidity wrappers, designed to enhance liquidity in otherwise illiquid markets. The introduction of the first standalone ETF, Standard & Poor’s Depository Receipts (SPY), also known as SPDRs or ‘Spiders’, by State Street Global Advisors in January 1993 marked a milestone in their development. The success of this ETF and its perceived ability to generate market liquidity paved the way for further growth and expansion of these instruments. Post-crisis, the number of ETFs has substantially increased, aligning with the shift towards market-based finance, as depicted in figure 2.

Figure 2. The post-crisis evolution of ETFs



Source: Pitcher Partners, 2022

2. Short comparison of passive investment – Index funds and ETFs

The asset managers can be historically categorized into two categories: active managers and passive managers. Active managers aim to outperform the market and generate excess returns (or ‘alpha’) compared to the benchmark they operate in. Historically, the active asset management industry has been characterized as long-only and focused on relative returns (Pozsar, 2015). On the other hand, passive managers replicate indices such as the S&P500 or broad bond indices. Their objective is not to outperform the benchmark but rather to track it by replicating its composition. Passive managers will be the subject of the following paragraphs.

The history of passive managers is said to have begun in 1976 when Jack Bogle, an advocate of indexing and the founder of Vanguard, launched the First Index Investment Trust with \$11.3 million in assets. Jack Bogle was inspired by two influential papers. The first paper is the *Challenge to Judgment*, published by Paul Samuelson, in which it was first stated that it is the opportune moment in which “some large foundation set up an in-house portfolio that tracks the S&P500 Index” (Samuelson, 1974: 18). The second paper, *The Loser’s Game* by Ellis (1975), was among the earliest papers that questioned the ability of active managers to outperform an index in the long run. It highlighted that institutionally managed funds in the sample were consistently falling behind the market represented by the S&P500 average. These papers cast doubts on the effectiveness of active management and laid the intellectual groundwork for index funds (Bogle, 2004). This phenomenon was further reinforced after the GFC, where it was demonstrated that only 23 percent of active funds outperformed their passive counterparts over a 10-year period ending in June 2019 (Johnson, 2019).

Passive investment can be broadly defined as encompassing index funds and ETFs, both of which provide investors with access to diversified indexed portfolios. Index funds resemble traditional mutual funds, receiving cash deposits and issuing shares based on the NAV of the fund (Kostovetsky, 2003). These deposits are then used to purchase bonds, stocks or other securities. However, index funds may experience tracking errors, which refer to their inability to perfectly replicate the performance of an index. One source of tracking errors in index funds is the cash drag effect (Kostovetsky, 2003). This effect arises from the maintenance of uninvested assets to meet redemption needs. In some cases, redemption needs can exceed the supply of uninvested assets, requiring the liquidation of certain securities to obtain the necessary cash reserves. The liquidations increase trading costs (Braun, 2016). Additionally, index funds lack a secondary market, with shares being bought and sold only at the end of the trading day at the market value of the underlying basket of securities (Braun, 2016).

ETFs have been designed to tackle these challenges. In the following discussion, we will delve into the creation and functioning of ETFs, drawing comparisons to index funds.

The creation process of an ETF through assetization follows a specific procedure. In the case of an equity ETF, it involves a create/redeem mechanism with an “authorized participant” (AP) playing a pivotal role. The process begins as the AP, typically a broker-dealer or a large financial institution, provides *in kind* a basket of securities that mirror the desired index. This predetermined basket corresponds to the objectives of the ETF. For example, if an ETF aims to track the FTSE 100, the AP will purchase shares from each constituent of the index in the same weight as the index. Once these shares are acquired and delivered to the ETF provider, the AP receives ETF shares in return, referred to as ‘creation units’. These creation units are usually bundled in blocks of 50,000 shares and have a value equivalent to the underlying securities, priced based on their NAV.

In the case of corporate bond ETFs, the functional principle remains the same, but the underlying securities consist of fixed-income instruments and broad bond indices, such as the S&P500 Bond Index, rather than equities. Additionally, the composition of bond ETF holdings differs from equity ETFs, as the share of bonds in the actual holdings is typically lower, sometimes less than 3 percent, due to less liquid nature and finite maturity of bond markets (Todorov, 2021).

The AP also assumes the role of a price-NAV arbitrageur, which is significant for ETFs. ETFs have two primary prices: the price of ETF shares, determined on secondary markets and accessible to investors, and the NAV, which represents the value of the underlying assets. To ensure proper functioning of an ETF, the price-NAV ratio should converge. In this context, the AP aims to maintain the ETF share price at the NAV level. How does the arbitrage process unfold? When a premium occurs, meaning that ETF shares are trading at a higher price than the underlying securities NAV, the AP can acquire the

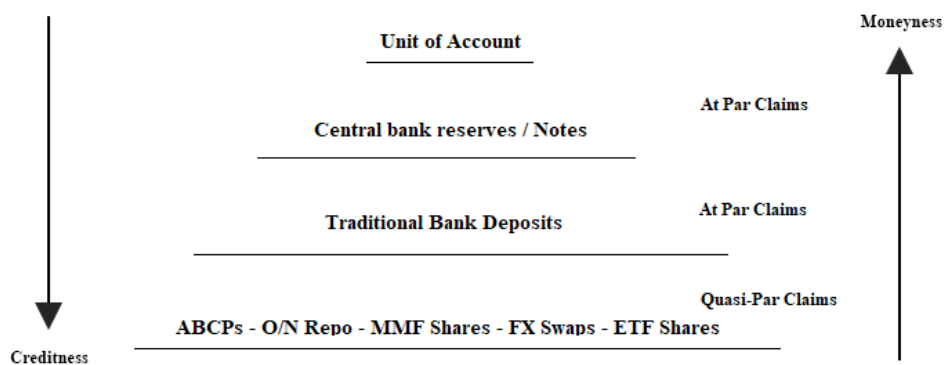
underlying securities and sell ETF shares on the secondary market. This activity brings the ETF share price closer to the NAV, allowing the AP to profit from the arbitrage mechanism of the price-NAV differential. Conversely, if ETF shares trade at a discount to the underlying securities, the AP can purchase these shares and redeem them for the underlying securities of the ETF, securities that can then be sold on the secondary market. This arbitrage mechanism applies to both equity ETFs and bonds ETFs, with the difference lying in the underlying securities (equities or bonds). It is this arbitrage mechanism that sets ETFs apart from index funds and contributes to their lower trading costs.

It is important to note that ETFs are based on an intraday NAV (iNAV), which is calculated at regular intervals throughout the trading day, in contrast to index funds that calculate NAV only at the end of the day. This intraday valuation enables ETFs to be bought and sold on exchanges, making them highly liquid. This ability to trade ETF shares freely throughout the trading day and the comparatively lower costs associated with ETFs, in contrast to the fees charged by active managers that can reach up to 10 percent of annual returns (French, 2008, quoted in Braun, 2016), are factors that contribute to their appeal among investors.

3. ETF shares as shadow money

Following the exploration of the shift towards market-based finance and passive management, our focus will now be on assessing whether ETF shares fulfill the criteria that define shadow money and whether they can be positioned within the hierarchy of money. This hierarchical framework draws inspiration from the Money View approach pioneered by Mehrling (2012) and Pozsar (2014). Illustrated in figure 3, the hierarchy of money demonstrates varying levels of creditness and moneyness. Of particular significance is the presence of shadow money in the outermost layer of the hierarchy, characterized by their quasi-par claims with bank deposits.

Figure 3. A simplistic representation of the hierarchy of money



Source: Author's representation

The hierarchy of money holds significant importance as money holds different meanings and roles for central banks, banks, and shadow banks (Pozsar, 2014). In the modern financial system, there exists a complex institutional arrangement wherein each institution issues money claims with varying degrees of moneyness. This moneyness is a crucial factor that distinguishes credit instruments within the hierarchy. Otherwise put, moneyness represents the capacity of an instrument to be regarded as a

close substitute for the liabilities of institutions at a higher level, effectively being treated as money rather than credit (Mehrling, 2012).

Moneyness is an inherent characteristic of every financial instrument, and it varies in response to the financial cycle. The concept of moneyness stems from a fundamental attribute of money itself, which is its convertibility at par. This convertibility emphasizes the hierarchical nature of the institutional arrangement, as not all money claims are equally strong in their ability to be converted at par on demand (Pozsar, 2014). In optimal financial conditions, moneyness tends to remain stable, reflecting the capacity of financial institutions to trade at par with higher forms of money within the hierarchy.

But the financial system possesses an endogenous and dynamic nature, highlighting the inherent instability of credit (Minsky, 1986). As a result, all segments of the hierarchy of money experience constant motion, fluctuating throughout financial cycles as economic actors' risk profiles evolve (Mehrling, 2012). It becomes evident that this convertibility at par is significantly impacted by crises.

The concept of moneyness holds significance as it underscores that monetary practices are fundamentally socially shared symbols; their acceptance is rooted in the shared trust in the governing authorities and the intricate framework of legal norms and institutions (Ingrao et al., 2021). It is this trust that positions central bank liabilities at the top of the hierarchy, as depicted in [figure 3](#). Consequently, central bank reserves are denominated in the unit of account and are convertible at par with commercial bank deposits, making them money for commercial banks. However, due to the fluctuating moneyness of shadow money, only a quasi-par convertibility exists between these new forms of shadow money and bank deposits. In simpler terms, for lower-rank forms of money, commercial banks deposits serve as money. The primary financial innovations occur in this lower layer of the hierarchy, which is predominantly driven by creditness.

This analysis holds relevance because the inclusion of ETF shares in the hierarchy of money imparts systemic significance to this instrument and allows for an examination of moneyness fluctuations during the Covid-19 pandemic crisis.

In the literature, there are three key criteria that contribute to the identification of a modern credit instrument as a form of shadow money (Pozsar, 2014; Murau & Pforr, 2020). These criteria entail that such instruments must: (1) serve as substitutes for bank deposits, (2) be tradable at par on demand, and (3) be created through the swap of IOUs (I Owe You). In the subsequent discussion, we will explore how these three criteria relate to ETF shares.

(a) Substitute for bank deposits

The first criterion can be comprehended from a demand-side perspective. The evolution of asset management has emphasized the significance of exploring new alternatives to bank deposits, given that the amounts held by institutional cash pools exceed the limits of deposit insurance, and maintaining large uninsured bank accounts entails unacceptable credit risk (Ricks, 2016). Consequently, the objective is to allocate these cash deposits into new private credit instruments that promise to be traded at par on demand while also yielding returns. ETF shares fulfill these requirements as they can be bought and sold promptly through secondary markets.

In this context, ETFs function as open-ended funds that invest in various assets such as stocks, bonds, commodities, and more. The return generated by ETFs can come from either capital gains, when the price of underlying assets increases, or dividends. Traders have the flexibility to open and close multiple

positions within a trading day. As a result, the capital invested in an ETF can be readily recovered by selling ETF shares on secondary markets. There are two primary methods of selling ETF shares. The first approach involves the direct sale of ETF shares on secondary markets. The second method is geared towards institutional investors and entails holding approximately 50,000 ETF block shares, as a creation unit, which can be redeemed for the underlying securities. Therefore, the role of ETFs as substitutes for bank deposits arises from the ability of retail and institutional investors to freely sell their shares on secondary market. This mechanism effectively equates ETF shares with bank deposits, establishing them as viable alternatives in the realm of shadow money.

(b) Par-clearance with higher-ranking money

The second criterion is considered a fundamental attribute of money (Pozsar, 2014) and becomes relevant when examining ETF shares as substitutes for bank deposits. This criterion emphasizes that shadow money instruments must possess a conversion rate into a hierarchically higher form of money. However, the ability of these private credit instruments, including ETF shares, to be traded at a nearly one-to-one ratio with a higher form of money, such as bank deposits, presents challenges in the absence of direct backstops, not only in the case of ETF shares. As depicted in figure 3, there exists a quasi-par claim with bank deposits, resulting from the fluctuation of moneyness in these instruments. Moneyness is inherently tied to the underlying securities of an ETF, as well as to the arbitrage mechanism. The purpose of this arbitrage mechanism is to safeguard the price-NAV differential from significant deviations and enable investors to redeem ETF shares at a fair value. It is worth noting that in times of distress, the redeeming ability of ETFs can be impacted, potentially leading to them being treated as closed-end funds and experiencing greater fluctuations in the price-NAV differential. An example of this was observed during the Covid-19 pandemic crisis, when the Fed intervened to support the corporate bond ETF markets. However, under optimal financial conditions, capital can be instantly withdrawn from ETF shares, and the arbitrage mechanism helps maintain the value of ETF shares close to their NAV. Therefore, it can be argued that this criterion is empirically satisfied, albeit with some reservations.

(c) Swap of IOUs

This third criterion can be examined from a supply-side perspective. The credit theory of money underlies the creation of all forms of shadow money (Schumpeter, 1954; Mehrling et al., 2013). According to this theory, shadow money, including bank deposits, can be understood as short-term debt instruments or IOUs, actively present on the balance sheets of financial institutions. Money creation occurs within these balance sheets through a swap of IOUs with different maturities (Mehrling, 2015). For example, in traditional banking system, deposits are created when a bank originates a loan and credits the customer's account. Thus, the swap of IOUs is intrinsically linked to the credit theory of money, where "money is nothing but a special form of credit, an IOU" (Murau & Pforr, 2020: 7). This swap of IOU follows double-entry bookkeeping principles, impacting both the assets and liabilities of the balance sheets. In the case of the swap of IOUs, money is created when financial institutions, in exchange for a long-term IOU owed to them, "create a short-term IOU that can be traded on secondary markets against (...) other financial instruments" (Murau, 2018: 9). Consequently, money creation arises from the exchange of promises to pay.

The question arises as to whether an ETF share satisfies the criterion of swaps of IOUs. Similar to MMF shares (e.g. Murau & Pforr, 2020), ETF shares can be viewed both as a conversion of existing deposits or assets and as a form of debt creation. In the case of MMF shares, some authors argue that MMFs

simply receive deposits and lend them out, thereby lacking an effective money creation process (Mitchell, 2017). However, some authors (Ricks, 2016) contend that MMFs engage in a process of swap of IOUs through maturity transformation. ETFs follow a similar pattern. During the initial creation of ETF shares, an AP supplies the ETF issuer with securities, typically less liquid assets, and receives ETF shares in return, which are subsequently sold on secondary markets. This process can occur multiple times as the AP participates in the arbitrage process. Thus, there is a swap of IOU for the initial creation of the ETF. Moreover, ETF shares are issued as promises to pay on demand. This transformation gives rise to a new credit instrument that can be traded on demand with a hierarchically higher form of money. Consequently, it can be argued that ETFs involve debt creation, with APs predominantly engaged in these swaps of IOUs. For clients, the process is less complex, as they can purchase ETF shares on secondary markets using cash deposits. Furthermore, clients have the option to lend out their ETF shares as a form of 'outside' securities lending through a lending agent (IHS Markit, 2017), allowing the swap of IOUs to occur across multiple layers.

Based on this analysis, it can be argued that ETF shares, although exhibiting certain functional differences, satisfy all three conditions to be considered a form of shadow money.

4. Moneyiness of corporate bond ETFs during Covid-19 pandemic crisis

Now we can delve into the concept of moneyiness as it applies to ETFs. As previously mentioned, there exists a "qualitative difference in the moneyiness of different promises to pay" (Mehrling, 2017: 2), with central bank liabilities occupying the highest position in this hierarchy. In the case of ETFs, the quasi-par/par convertibility relies on the liquidity of the underlying securities and, by extension, on the discussed arbitrage mechanism.

During periods of economic stability, corporate bonds ETFs are considered liquid because they can be easily traded on exchanges, and APs promptly respond to price-NAV differentials. This perception leads to the notion that these instruments are more liquid than they truly are. However, challenges arise when expectations about these instruments deteriorate, as investors tend to redeem their holdings *en masse*, and APs may modify their behavior accordingly. This scenario unfolded during the pandemic crisis, exemplified by Vanguard's Total Bond Market ETF (BND), one of the largest ETFs, trading at a discount of 6.2 percent relative to NAV, and the Schwab U.S. Aggregate Bond ETF (SCHZ) trading at a discount of 6.3 percent. Hence, one could argue that the moneyiness of these credit instruments is contingent upon the specific markets in which they are traded, as well as the price-NAV arbitrage mechanism. Therefore, concerns regarding the maintenance of ETF moneyiness stem from the potential behavior of APs and market-making during periods of distress.

Moving forward, it is posited that three major factors can negatively impact this moneyiness: (a) the malfunctioning of the arbitrage mechanism during significant sell-offs, (b) the inventory management practices of certain APs, and (c) the liquidity mismatches. We will further explore these three factors in the subsequent discussion.

(a) The malfunctioning of the arbitrage mechanism

The first cause stems from the inability of the previously discussed arbitrage mechanism to converge the NAV in the presence of a liquidity glut and significant sell-offs. During such periods, APs face elevated risks when pricing ETF portfolios, resulting in larger bid-ask spreads. Furthermore, APs are not legally obligate to engage in arbitrage activities to rectify price-NAV deviations. In other words,

discounts may persist due to the hedging risks outweighing the arbitrage incentives of the APs. Additionally, APs possess the authority to halt the creation and redemption of ETF shares entirely, particularly during periods of significant decline in the value of underlying securities.

Similar situations can arise when internal liquidity constraints come into play. For instance, in April 2013, Citibank halted redemptions of the iShares J.P. Morgan USD Emerging Market Bond ETF. In such cases, the ETF would resemble a closed-end fund. The rationale behind this action is that if redemptions were allowed, the AP would receive illiquid securities with low market value. In extraordinary circumstances, this phenomenon can give rise to illiquid doom spirals, wherein sell-offs extend to other markets, further impacting the value of underlying securities.

Considering ETFs discussed in this paper are based on a basket of OTC-traded corporate bonds, there is an inherent risk of these bonds becoming illiquid. Moreover, the ability to buy and sell corporate bonds has become more challenging in recent times (Lamont, 2020). For instance, during the pandemic crisis, one problem arose from the rapid deterioration of liquidity in bond markets, as broker-dealers reduced their activity due to increased costs resulting from post-GFC regulations (Lamont, 2020). Other researchers have reached similar conclusions, suggesting that the large NAV deviations observed in corporate bond ETFs during the pandemic could also be attributed to APs' balance sheet constraints, as certain investment banks, fulfilling the role of arbitrageurs, faced difficulties (Tuckwell, 2020).

With APs lacking a legal obligation to intervene and rebalance the price-NAV ratio of the ETF, discounts can persist for extended durations, as evidenced during the pandemic crisis (e.g. Todorov, 2021). In the first half of 2020 alone, more than 72 ETFs, valued at \$1.4bn, ceased operations (Greifeld & Kochkodin, 2020). Furthermore, during that period, APs were hesitant to engage in arbitrage processes, resulting in over 700 ETFs trading at prices 1 percent higher or lower than their fund's NAV (Riquier, 2020). For example, the iShares iBoxx \$ High Yield US Corporate Bond ETF lost 20 percent of its value between March 2 and March 23, 2020 (Gerstein, 2020). These operational inefficiencies caused steep discount in share prices relative to NAV to transform into substantial premiums, with tracking errors increasing to nearly 200bps, significantly higher than the average of 0.7bps (Todorov, 2021).

(b) The inventory management

The second factor influencing moneyness is the inventory management of APs, which has contributed to significant liquidity disruptions in corporate bond ETFs, even during periods of high trading activity. This was evident in cases where both the price of ETF shares and the NAV traded at inaccurate prices, such as with the iShares iBoxx \$ Investment Grade Corporate Bond ETF during the pandemic crisis. It was found that 92 percent of underlying bonds traded while experiencing a substantial price-NAV deviation (Janosik & Bohak, 2020). This phenomenon can be attributed to certain broker-dealers engaging in dual roles as market-makers in underlying assets and arbitrageurs in specific ETFs. In such situations, an AP may participate in the creation and redemption processes to manage its own inventory and mitigate risks on its balance sheet, rather than focusing on rebalancing the price-NAV. This approach can lead to even larger price gaps. APs hold bond inventory and participate in the bond market-making process, but imbalances in its inventory can increase risks and undermine arbitrage capacity (Pan & Zeng, 2017). As a result, the arbitrage mechanism may prioritize the reduction of inventory imbalances instead of directly addressing the price-NAV differential, thereby disregarding the fundamentals of the underlying securities (Pan & Zeng, 2017). Moreover, considering the frequent changes in the composition of an ETF due to the finite nature of the underlying assets, it can be argued that an AP may decide to use the bond holdings to "accommodate demand from their own clients rather than to close arbitrage gaps" (Todorov, 2021: 42).

This dual behavior of APs highlights the heightened risk of liquidity disruptions in the ETF market during times of distress, particularly considering the reduced inventory levels and the broker-dealers' preference for holding more liquid bonds in the post-crisis era. The pandemic crisis exacerbates these risks, raising significant concerns about the tradability of illiquid bonds during periods of liquidity shock (Maitra et al., 2020). This situation further decreased the arbitrage capacity.

Additionally, the risk of liquidity dislocation is elevated due to a significant number of bonds being traded infrequently, primarily held in insurance and pension portfolios to match liabilities while earning a premium over the risk-free rate (Maitra et al., 2020). This limited trading activity in the bond market reduces overall market liquidity. The liquidity, measured by turnover, has declined 43 percent from its pre-crisis peak during the pandemic crisis (Lamont, 2020). Consequently, it is one of the key factors contributing to the significant discounts observed in 80 percent of investment-grade corporate ETFs during the initial phase of the pandemic crisis (Eckett, 2020).

(c) Liquidity mismatch

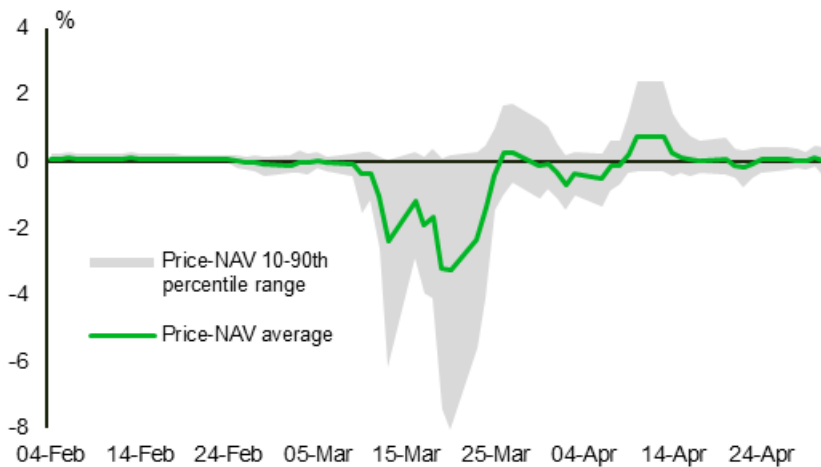
This inventory management approach can result in 'liquidity mismatches' between the NAV of underlying securities and the price of ETF shares. These discrepancies are particularly evident when ETFs are exposed to vulnerable corporate bonds, highlighting differences in trading conditions. ETF shares are traded on major exchanges in secondary markets, while corporate bonds are traded OTC, leading to tensions and challenges. If an AP holds a positive inventory of additional corporate bonds, they can create ETF shares by submitting the bonds to the ETF issuer. However, if the AP has had limited activity in the bond market and maintains a lower inventory, their ability to engage in the arbitrage mechanism significantly diminishes.

Furthermore, the creation/redemption process in corporate bond ETFs differs from that of equity ETF due to the constant rebalancing required for bond maturities. This necessitates the ongoing update of the underlying bond basket (see Todorov, 2021). This update occurs either by adding new bonds or by removing others, as the AP has to buy the "the lower-priced asset, simultaneously selling the higher-priced asset, and directly trading with the ETF issuer at the end of a trading day" (Pan & Zeng, 2017: 1). As a result, the AP is compelled to hold a substantial and leveraged bond inventory, constantly exposing themselves to new inventory risks.

These risks are related to the liquidity of the corporate bonds, which can be more directly impacted by potential financial turmoil. Timing also presents a risk, as bond transactions in primary and secondary markets often occur at different times. This exposes APs to the risk of price differential, which can erode trade profitability and impact their inventories (Solovieva & Khosla, 2018). Consequently, during times of distress, APs may become liquidity-seekers rather than providers, exacerbating the liquidity mismatch (Pan & Zeng, 2017).

This mismatch was evident during the pandemic crisis, where the average discount for corporate bond ETFs was calculated to be 3.62 percent, reflecting the impact of these factors on the market. This discount is depicted in figure 4.

Figure 4. Price-NAV Deviations in US ETFs Corporate Bond Market



Source: Solovieva & Hostland (2020)

The onset of the pandemic crisis led to a significant deterioration in market activity within the bonds market. This decline also impacted investment-grade corporate bond ETFs, which experienced discounts of 5-6 percent relative to NAV, with intra-day price deviations reaching 10 percent. These levels had not been observed since 2008. For instance, LQD (iShares iBoxx \$ Investment Grade Corporate Bond ETF) reached a 5 percent discount on March 12, 2020.

This event highlighted the potential for liquidity to evaporate during distressing conditions, particularly in fundamentally illiquid markets like corporate bonds. Such circumstances can leave ETFs in an unfavorable position, especially “(...) when primary market trades have trouble executing at short notice, at a low cost, and with minimal price impact” (Solovieva & Khosla, 2018: 3).

Furthermore, the pandemic crisis, underscored the more pro-cyclical nature of ETFs compared to mutual funds. Investors in ETFs exhibit different sensitivities to the price movements of underlying securities. As previously discussed, when the price of underlying securities is on an upward trend, investors tend to increase their holdings of ETF shares. Conversely, during volatile economic conditions, there is a constant transfer of assets between ETFs with varying degrees of risk. This behavior can give rise to the illiquid doom spiral phenomenon.

For example, BlackRock’s I Shares 1-3 Year Treasury Bond ETF (SHY) initially benefited from massive funding flows in early March, as investors sought safety in a flight to quality. However, it subsequently experienced significant outflows after the Fed unleashed its stimulus package (Clements, 2020). Overall, the pandemic crisis brought to light the impact of market conditions on ETFs, with liquidity challenges and the pro-cyclical dynamics of investor behavior playing significant roles in shaping ETF performance.

5. The Federal Reserve’s entanglement with ETF market

The Fed recognized the potential negative effects of moneyiness deviations in various bond markets and extended its backstop to encompass this novel form of shadow money. This reaffirmed the central banks’ crucial role in maintaining the stability of the monetary hierarchy. During severe crises, it is

primarily the state, mostly through its central banks, that acts as the ultimate stabilizer (Wullweber, 2021).

In optimal financial conditions, credit claims can be easily expanded without losing value. However, during a financial turmoil, central banks must protect whole markets. This was also the case for corporate bond ETFs during the Covid-19 crisis. As we discussed earlier, ETFs do not have a direct backstop but rely on the arbitrage mechanism. However, this arbitrage does not always function effectively, which can impact the moneyiness of ETF shares. During the Covid-19 crisis, the Fed took the unprecedented step of backstopping ETF shares to prevent a loss of moneyiness, as such a loss would have significantly affected the corporate bond markets as a whole.

The Fed intervened through the creation of the Secondary Market Corporate Credit Facility (SMCCF) in March 2020. The facility aimed to reduce price-NAV differentials and enhance liquidity in corporate bond market. By doing so, the Fed sought to improve the functioning of the arbitrage mechanism and reinforce the par clearance feature of ETF shares with a higher-ranking form of money. In this context, the Fed once again assumed the role of the dealer of last resort, this time in the ETF market (Mehrling, 2011). The announcement of the Primary Market Corporate Credit Facility (PMCCF) and SMCCF on March 23 led to a recovery in the financial sector, with investment-grade credit spreads narrowing by 20bps and high-yield falling by 30bps (Gilchrist, 2021).

Despite these measures, issues persisted in the corporate bond ETF market, prompting the Fed to introduce a significant policy change. It included investment-grade and junk corporate bond ETFs in its corporate bond-buying facilities, which meant that the Fed began to assume credit risk on its own balance sheet. The move turned the SMCCF into a public endorsement of these credit instruments. Figure 5 presents a spreadsheet displaying the holdings of the Fed.

Figure 5. Fed's holdings in corporate bond ETFs

Ticker	Fund Name	Shares Purchased ¹	Market Value as of December 31, 2020 (US \$)
ANGL	VanEck Vectors Fallen Angel High Yield Bond ETF	1,129,770	36,265,617.00
HYG	iShares iBoxx High Yield Corporate Bond ETF	3,875,790	338,356,467.00
HYLB	Xtrackers US Dollar High Yield Corporate Bond ETF	1,644,970	82,396,547.30
IGIB	iShares Intermediate-Term Corporate Bond ETF	8,046,720	497,206,828.80
IGSB	iShares Short-Term Corporate Bond ETF	12,448,466	686,781,869.22
JNK	SPDR Bloomberg Barclays High Yield Bond ETF	5,285,048	575,753,129.12
LQD	iShares iBoxx US Dollar Investment Grade Corporate Bond ETF	17,860,663	2,467,093,380.19
SHYG	iShares 0-5 Year High Yield Corporate Bond ETF	685,850	31,165,024.00
SJNK	SPDR Bloomberg Barclays Short Term High Yield Bond ETF	1,220,506	32,892,636.70
SLQD	iShares 0-5 Year Investment Grade Corporate Bond ETF	841,975	43,967,934.50
SPIB	SPDR Portfolio Intermediate Term Corporate Bond ETF	13,181,447	490,086,199.46
SPSB	SPDR Portfolio Short Term Corporate Bond ETF	8,954,460	281,170,044.00
USHY	iShares Broad US Dollar High Yield Corporate Bond ETF	1,555,865	64,194,989.90
USIG	iShares Broad US Dollar Investment Grade Corporate Bond ETF	2,997,120	185,731,526.40
VCIT	Vanguard Intermediate-Term Corporate Bond ETF	14,875,069	1,444,964,202.66
VCSH	Vanguard Short-Term Corporate Bond ETF	18,237,015	1,518,231,498.75

1. Includes all ETFs purchased through December 29, 2020 with contractual settlement date through December 31, 2020. No purchases were made over the current reporting period.

Source: Federal Reserve' SMCCF Update to Congress

Figure 5 displays the names of the funds and their corresponding market values of the purchased ETF shares by the Fed. These interventions had significant consequences. Following the Fed's announcement, iShares iBoxx \$ Investment Grade Corporate Bond ETF (LQD) experienced a substantial inflow of \$1.06bn, representing 7.4 percent (Clements, 2020). Similar inflows were observed for Vanguard Intermediate-Term Corporate Bond ETF (VCIT) and Vanguard Short-Term Corporate Bond ETF (VCSH). This influx of capital had positive impact. As depicted in figure 3, there were

significant price-NAV deviations in March 2020. However, these deviations were mitigated on March 24-25 when the Fed announced the introduction of the SMCCF.

By extending its post-crisis backstop to the ETF market, the Fed acknowledged the growing significance of these instruments in market-based finance. Although the SMCCF was a temporary facility, it underscored the Fed's capability and willingness to safeguard the moneyness of this new form of shadow money, as emphasized in this paper.

6. Concluding remarks

The study commenced by examining the transformation of the shadow banking system into market-based finance, driven by investors seeking a 'flight-to-transparency' and reducing exposure to riskier aspects of the shadow banking system. This shift elevated the significance of collective investment schemes and other index businesses, particularly ETFs, within the system. Assetization played a crucial role in the rise of ETFs, enabling an index, which possessed use value, to acquire exchange value. Subsequently, this paper employed an existing methodological framework rooted in shadow money literature to analyze ETF shares based on the three established criteria: their function as a substitute for bank deposits, their emergence from a swap of IOUs, and their at par convertibility. Through this analysis, the paper demonstrates that ETF shares satisfy all three criteria, solidifying their classification as a distinct form of shadow money. Consequently, ETF shares were positioned within the hierarchy of money.

Drawing on the Covid-19 crisis as a case study, this paper examined the deviation of ETF moneyness. Three key factors contributing to the loss of moneyness were identified: the malfunctioning of the arbitrage mechanism during substantial sell-offs, the inventory management practices by certain APs, and liquidity mismatches. As ETF shares gained systemic importance as a form of shadow money, the Fed made the decision to backstop these instruments. The empirical analysis of the Fed's interventions shed light on the motivations behind the Fed's purchases of ETF shares.

This paper emphasizes the need for scholars to devote greater attention to ETFs, given their potential for leveraging and supporting other structured financial instruments. Some ETFs may have collateralized debt obligations (CDOs) and collateralized loan obligations (CLOs) as underlying securities, further amplifying their role as leverage mechanisms within the financial sector (Velati, 2023). The implications of this analysis extend to shadow money literature and financial stability, urging further consideration of ETFs in these research domains.

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