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Master's Degree Programme in
Economics and Finance
Second Cycle (D.M. 270/2004)

Final Thesis

ETFs: Investigation on the Possible Threats to Financial Stability

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Academic Year
2017 / 2018

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INTRODUCTION

New financial regulations and a re-shaping of the market landscape are pushing investors' interest towards passive investment vehicles; in particular, exchange traded funds have experienced the fastest growth among these latter in the recent years. Thanks to their unique characteristics, these instruments have boosted the democratization of financial markets and have created new opportunities for portfolio construction, widening the range of securities any individual with a brokerage account can invest in. Many concerns arose though, regarding the risks ETFs might represent for financial stability. There are evidences that ETFs, through their creation and redemption mechanism and intrinsic arbitrage activity, are influencing the values of their underlying portfolios creating new channels for shocks propagation.

In this work, I am going to conduct a thorough analysis of this relatively new dynamic industry driven by the willing to create a complete overview on the advantages and disadvantages of these instruments and the measures regulators are taking to control the side effects connected with their usage. In particular, with the help of the academic literature, I am going to walk the reader through some simple questions regarding the way ETFs may affect the financial markets via their peculiar features.

As we will see, the method used to create and to redeem ETFs shares differs from classic investment funds and requires the creation of two market levels. First, Authorized Participants need to deal with the ETF sponsor in order to buy (create) or redeem the fund shares and only afterwards they can sell or buy them in the open global exchanges. As a consequence, ETFs can have two different values, one corresponding their NAVs applied to sponsor-APs transactions and one represented by the fund shares prices in the financial exchanges. Arbitrage activity is required to keep the two values aligned, in order to not create inefficiencies and discrepancies in the markets.

On the extent that arbitrageurs need to take opposite position on the ETFs and their underlying portfolios we wonder if this creates a channel for the propagation of non-fundamental shocks from the fund to its components enhancing volatility in financial markets. We further ask if this potential noise spreading does create similarities in the behavior of ETFs underlying assets returns, creating commonality among these securities with possible exacerbation during crisis.

In addition, given the broad landscape of ETFs categories, differentiating by replicated assets, employed strategies and tracking mechanisms. I decided to focus on the existence of specific risks

represented by synthetic replication methods, given that they expose investors to a counterparty risk, as opposed to the tracking error chance in physical ETFs.

Finally, considering the relevant role of institutional investors in the industry, we question on the responsibility they have during crisis in maintaining the efficiency of the funds mechanisms and if the measures taken by regulators are consistent, focusing on the evidences from 2 market crashes particularly.

The first chapter will introduce the reader to the ETFs world providing important information about size and development of this sector and ETFs characteristics, usage and mechanisms. In the second chapter, ETFs activity will be analyzed and the consequences their usage is having on their components will be brought out of the shadows.

It is important to highlight that this second part will be more focused on the U.S. market due to its size. The effects that these instruments have on financial markets can be observed in a larger scale and more significant researches have been conducted on them. Furthermore, the structure of the investors landscape needs to be considered as well: while the U.S. ETFs industry includes a more evenly distribution among institutional and retail investors, the European market has so far been dominated by professional clients[1].

The third chapter will describe the 2010 Flash Crash and how high volatility and liquidity shortages undermined the ETFs price discovery activity, intended as the correct replication of their underlying assets value. Lastly, I will talk about the regulatory evolution of the industry, focusing mostly on the recent MiFID II implementation in Europe and how regulators are trying to increase the industry transparency.

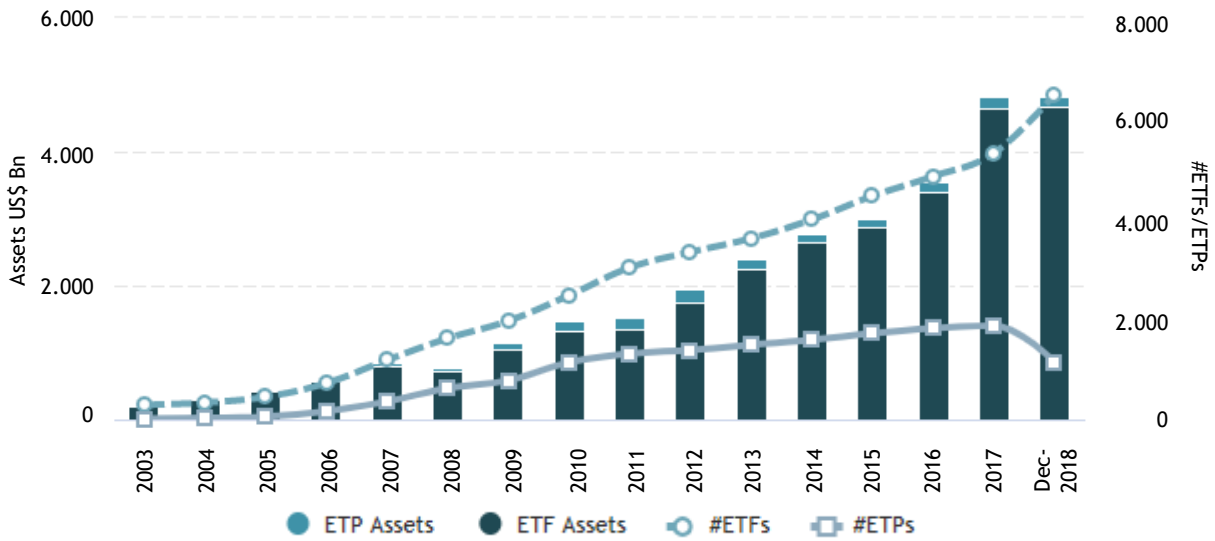
In the conclusion we are going to summarize the findings of this work and to formulate the answers to our questions.

[1] Thomadakis, 2018.

I. INDUSTRY OVERVIEW

Exchange traded funds have been representing one the of the fastest growing industries in financial markets in the recent years. The SPDR S&P 500 Trust ETF (SPY), the first U.S. exchange traded fund, was created by State Street Global Advisors in 1993 with the aim of tracking the S&P 500 index and it now represents the largest ETF with approximately 259$ billion in asset under management[2]. As shown in Graph 1, global ETFs AUM grew from 417$ billion in 2005 to 1.3$ trillion in 2010, until capturing an extraordinary 5.22$ trillion in August 2018 [3].

Graph 1 Global ETF and ETP Growth 2003-2018



Source: ETFGI data.

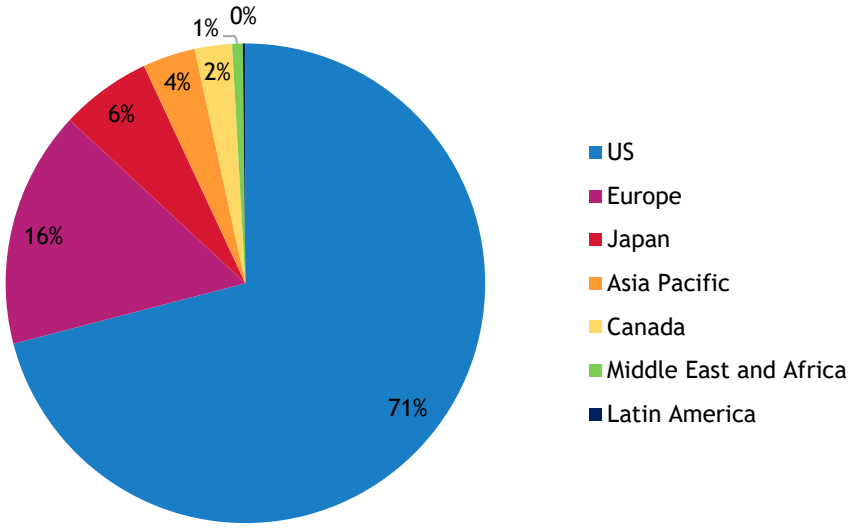
Moreover, if we look to the relative values of their growth, ETFs have outpaced other open-end funds (i.e. mutual funds) achieving an average annualized rate of 19% from 2009 to 2017, against the 4,8% scored by the latter. In 2016, ETFs industry has then reached an important milestone: it has overtaken hedge funds global AUM and BlackRock is expecting them to become a $12 trillion-worth sector in 2023[4].

[2] https://us.spdrs.com/etf/spdr-sp-500-etf-SPY.
[3] EY, 2017; Ramaswamy, 2011; ETFGI, 2018.
[4] Maier, 2017; Small, Cohen and Dieterich, 2018.

Surprisingly, their growth hasn't even been undermined by the 2007-2008 financial crisis. In fact, thanks to their characteristics, they represented an appealing investment opportunity both for institutional and retail investors seeking, the firsts, a liquid and fast way to globally diversify their portfolios and, the seconds, cheap and transparent long-term equity investing[5].

With regards to the industry global distribution, as the end of August 2018, of the 5,068$ trillion global ETFs AUM, the United States were embodying the biggest player, capturing more than the 70%, followed by Europe with a modest 16%, as we can see in Graph 2.

Graph 2 Global ETFs at the end of August 2018 by Region



Source: ETFGI data.

1. THE ACTIVE-TO-PASSIVE INVESTING TRANSITION

The increasing pace at which these instruments are growing reflects a market structure re-shaping that has been happening in the last 20 years. Asset management activity is globally shifting from active to passive investing: even though active management continues to play an important role in the market, on a global scale, index investing has grown to 21,6% of the total assets managed at the end of 2016, gaining 5,1% shares in the last 5 years[6].

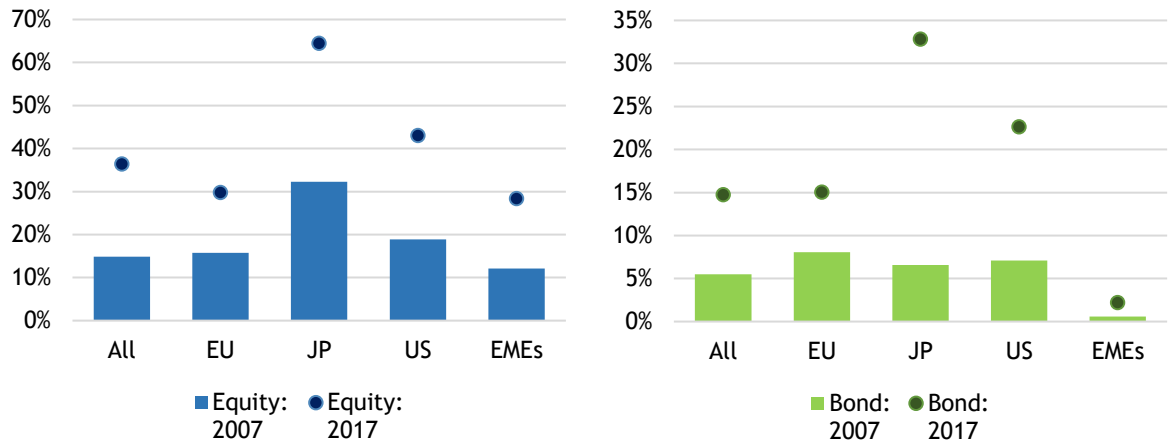
[5] Evans and Wilson, 2018.
[6] Willis Tower Watson, 2017.

Regarding to this matter, assets under management are an easy and practical way to measure funds industry size but they can sometimes show an imperfect picture. Active funds have started to build portfolios more and more similar to the one hold by the market index, threatened by the capital outflows they could experience when underperforming their benchmark and, doing so, blurring the lines between passive and active investment strategies[7]. This phenomenon, defined as "closet investing", is found to be employed in the same proportion as explicit indexing in some countries and, in particular, by active bond funds[8].

The increase in passive investing has been experienced both in equity and bond asset classes even though it's keeping being focused on the former, probably due to their greater liquidity and easier trackability in comparison to the debt securities.

As shown in Graph 3, geographically passive investment gained popularity mostly in the U.S., comprising the 43% of total U.S. equity fund assets in 2017. In Japan its growth has been pushed both by the Central Bank assets purchase program (now holding roughly the 60% of the total Japanese Equity ETFs) and the Government Pension Investment Fund, which allocated the 80% of its equity investment in passive vehicles over recent years[9].

Graph 3 Passive Funds Share of Investment Fund Assets, by Geographical Focus



Source: Sushko and Turner, 2018.

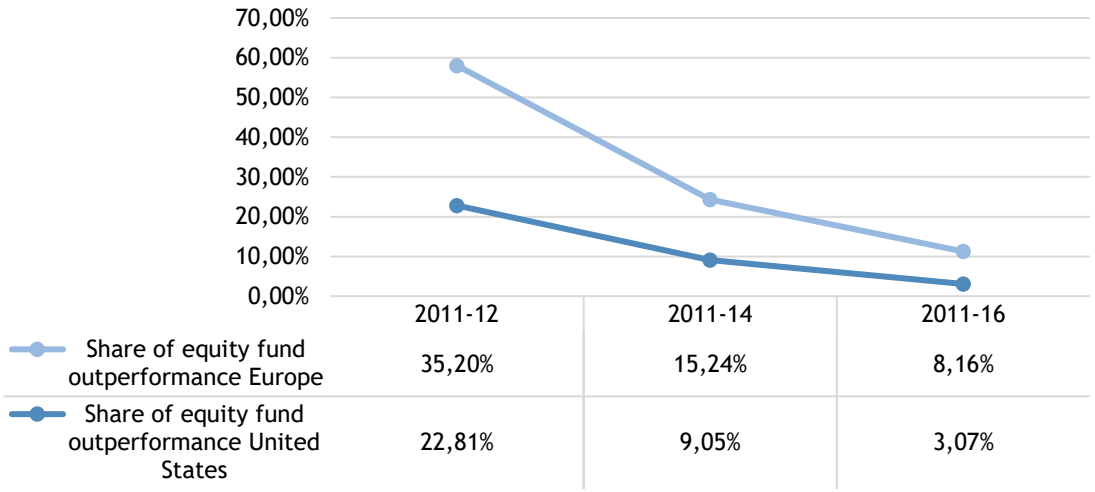
But what are the divers of this boost in index investing? From a theoretical point of view, the roots lay in the Efficient Market Hypothesis according to which securities prices reflect all the available

[7] Sushko and Turner, 2018.
[8] Cremers, Ferreira, Matos and Starks, 2016.
[9] Sushko and Turner, 2018.

information, making future excess returns unpredictable[10]. It follows that there is limited space for active managers to systematically outperform the market portfolio, undermining the grounds to pay higher fees than the ones needed to just maintain a good diversified market portfolio[11].

At a practical level, different factors can be identified as key drivers of the active-to-passive investing shifting. The most intuitive and direct one regards their performances: active funds have broadly failed to achieve their target return in recent years. In 2016, S&P Dow Jones Indices investigated about the global performance of active fund managers and reported that more than 90% of them didn't outperform their benchmark over the past 1, 5 and 10-years periods[12]. Moreover, from 2011 to 2012, 35% of European equity funds succeeded to beat their predetermined benchmark but if we take a look to the broader picture, we find out that in the last 6 years, as anticipated before, only the 8% succeeded in beating their target globally[13]. The principal cause of this negative trend is connected to the fees applied by active funds, as it's reported by different studies[14] that found out the average active equity fund does not achieve returns superior to its benchmark in the long run, after fees and other expenses are deducted. Graph 4 reports the performance statistics both for European and United States equity funds divided in three different time horizons: 2, 4 and 6 years.

Graph 4 Share of Active Funds Outperforming their Benchmark During the Corresponding Periods



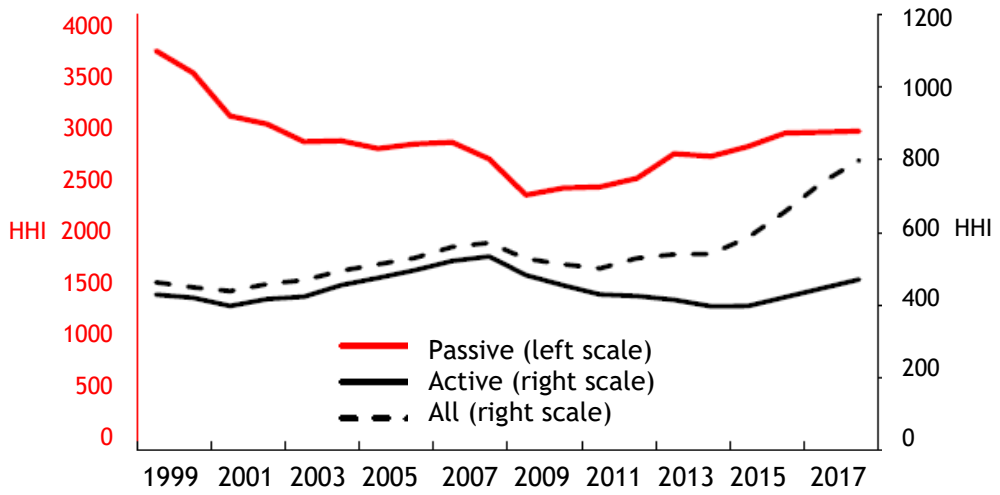
Source: Sushko and Turner, 2018.

[10] Fama, Fisher, Jensen, and Roll, 1969
[11] Sushko and Turner, 2018.
[12] Stein, 2017.
[13] Sushko and Turner, 2018.
[14] Jenson, 1968; Carhart, 1997; Fama and French, 2010; Busse et al, 2014.

Index investing reports lower expenses ratios by nature: since their aim is the simple replication of the chosen index behavior they do not incur in as much market research expenses as active funds. This obviously creates a basic advantage for passive investing that has been accentuated by a combined effect of the inflow and market concentration increase in the industry. In fact, BlackRock, Vanguard and State Street Global Advisors, the three largest fund managers[15], have collected the 70% of the total passive inflows starting from 2010, causing an increase in the already high Herfindahl-Hirschman Indexes[16]. In Graph 5 a comparison between passive (left axis) and active (right axis) funds HHIs is reported. As we can see, the difference in the two categories is quite big: since 2004, the average has been equal to 2800 for the former and 450 for the latter.

The industry concentration is also reflected by the market share of the total passive AUM, being the 90% of that condensed within the 10 largest passive funds providers. Such phenomenon allows for the exploitation of economies of scale and scope by the largest players, which are able to spread fixed costs over a wider assets basis and so squeezing the applied fees. Indeed, Graph 6 shows the decreasing evolution of the average expense ratios of US mutual index funds and ETFs from 2000 to 2016[17].

Graph 5 Concentration of Active and Passive Investment Funds



Source: Center for Research in Securities Prices, Wharton Research Data Services.

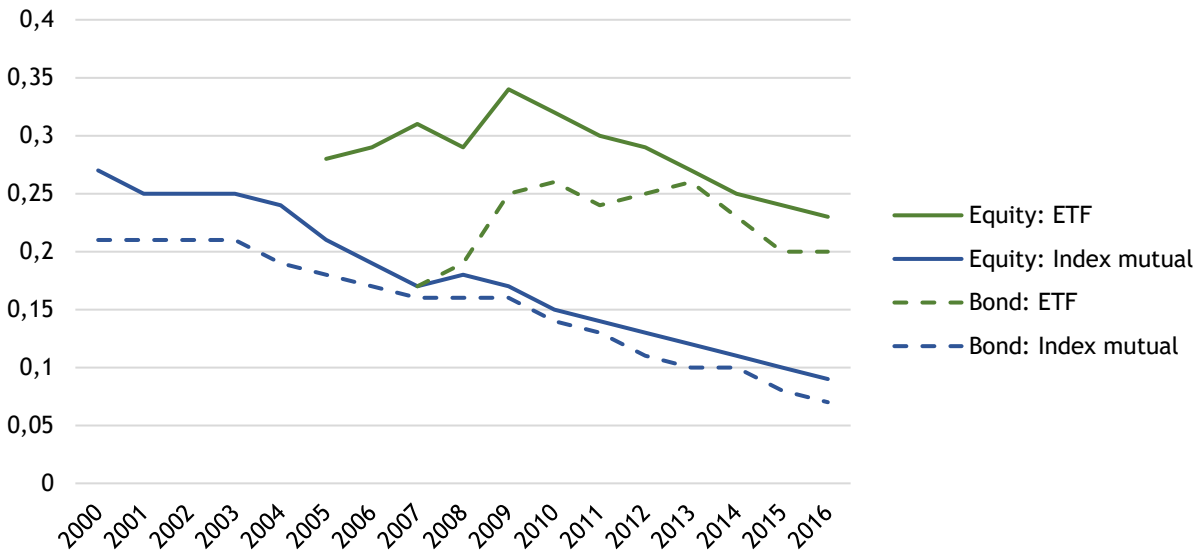
[15] IPE, The Top 400 Asset Managers, 2018

[16] HHIs is the most commonly known measure for market concentration. High concentration is indicated by values equal or greater than 2500

[17] Anadu et al, 2018; Sushko and Turner, 2018.

Active investment funds fees structure has been put under pressure also by the introduction of automated algorithmic investing that has increased the competition by offering low-cost investment services.

Graph 6 US Index Mutual Funds and ETFs Expense Ratios



Source: Sushko and Turner, 2018.

In Europe there have been researches investigating the role played by the Markets in Financial Instruments Directive II, introduced in January 2018, in the structural shifting in the asset management industry. The rating agency Moody's sustain the greater cost transparency will increase the competition between financial services providers, making easier for both investors and competitors to confront investment products. This will lower down the average level of industry fees and will encourage the shift to passive investing[18].

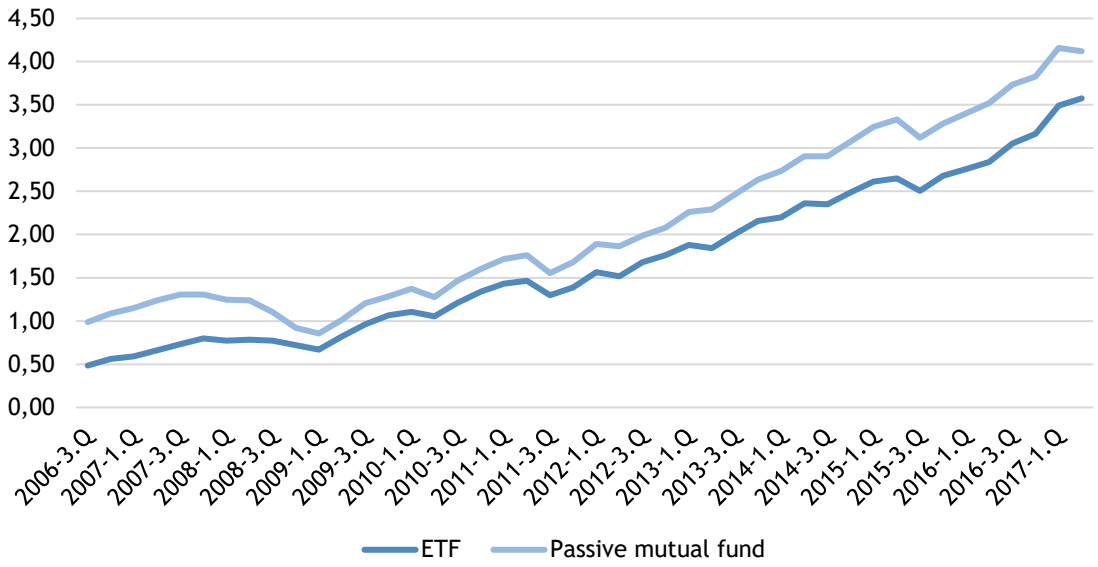
Moreover, the recent proliferation of indexes has made passive investing more appealing. In May 2017 Bloomberg declared that in the US equity market the number of indexes outdid the number of stocks, making more easier for investors to differentiate their portfolios since able to choose

[18] https://www.ftadviser.com/david-thorpe/

among a wider range of approaches and securities baskets. Also, the growing popularity of smart beta indices is accessory to this[19].

Finally, the democratization of information has diminished the advantage of privileged investors having special access to news since it translates in a faster and more efficient incorporation of new data into securities prices[20].

Graph 7 Passive Mutual Funds and ETFs AUM (in $trn)



Source: Sushko and Turner, 2018.

It is worth noticing that ETFs[21] share in the total passive managed assets grew from 30% to 40% from 2007 to 2017, representing the fastest developing category among passive investment products. As shown in Graph 7, ETFs AUM has always grown together with mutual funds flows and, thanks to their unique characteristics there are no doubts about their contribution to the passive industry growth and more widely to the investment management business[22].

[19] Smart beta strategies aim to combine both passive and active investing benefits. They seek to replicate indexes behavior but employing alternative weighting strategies based on volatility, liquidity, value, size and quality.
[20] FTSE Russell, 2017.
[21] There exist some ETFs offering active strategies to investors though, seeking to return higher results in comparison to a benchmark. They represent only the 2% of the total ETF assets though (Sushko and Turner (2018)).
[22] Sushko and Turner, 2018; FTSE Russell, 2017, Hill et al, 2015

2. ETFs CHARACTERISTICS

We are now going to focus on ETFs characteristics in order to construct a good landscape for our analysis.

ETFs can be considered as hybrid investment products, combining characteristics of mutual funds and common stocks. As mutual funds, individuals can invest in ETFs by buying fund shares in order to obtain a proportional exposure to the basket securities. ETFs shares are traded continuously during the day on global exchange though, differentiating from common open-end funds, which shares can be redeemed or subscribed only at the end of the trading day at NAV. For this reason, they need market determined continuous pricing and offer instant liquidity to investors.

It's important to underlie that these instruments have created new opportunities for portfolio construction widening the range of securities any individual with a brokerage account can invest in. In fact, before their introduction, was extremely hard and costly for retail investors to own less liquid and more volatile assets as emerging markets bonds, currencies, commodities or alternative assets. In addition, ETFs offer remarkable trading flexibility since they trade as regular stocks: investors can short sell them, buy on margins, some have options on them and investors can place stop or limit orders to get the optimal price. In other words, they have created a level playing field accessible to basically everyone no matter the time horizon or the asset size[23].

Before ETFs got popular though, investors could purchase closed-end funds shares. The most important difference is that exchange traded funds have an improved creation-redemption mechanism (which we are going to focus on later in this chapter) that grants their market value to be close to their true net asset value.

Since they are exchange traded, individual investors need to use brokerage accounts to buy or sell ETFs shares, meaning that, in general, all the expenses connected to investors record-keeping, inquiries and distribution are borne by the broker. Moreover, as we underlined before, most ETFs are indexed and consequently they avoid active portfolios management related expenses. That is way, ETFs are considered cost- efficient instruments.

In a 10-years period ending in November 2011, investors in the SSGA S&P 500 Mutual Fund had an annual after-tax return of 6,77%; on the other hand, an individual who bought shares in the

[23] Hill et al, 2015.

SPY, considering the same time horizon, obtained 7,12%. Since the two instruments tracks the same index, we would have expected them to get the same performance, we need to consider the tax advantage enjoyed by ETFs investors though. In fact, according to a Morningstar research, those yearly 35 bps of increased profit are mainly due to tax deferral arising from both low asset turnover and in-kind redemption. Since ETFs usually employ index investing strategies, they have a lower asset turnover with respect to actively managed funds. Mutual funds then, are usual to distribute capital gains arising, as an example, from selling some appreciated shares in order to obtain cash needed for paying investors redemptions. The individual then, will need to pay taxes on that profit. On the contrary, ETFs reduce unrealized gains by delivering (or accepting) the underlying securities basket in exchange of the fund shares[24]. The Investment Company Institute has in fact observed that, in 2013, 51% of equity mutual funds paid out capital gains, in contrast with the ETFs 3,87%.

Transparency is another characteristic really appreciated by ETFs investors. These funds usually disclose their whole portfolio on a daily basis, allowing individuals to know exactly what they are investing in and making portfolio analysis and construction easier. In addition, it reduces managers incentives to do style drift investing[25] or investors hidden exposure problems. On the contrary mutual funds and actively managed funds in general publish their holding on a quarterly basis since the disclosure could be negative for their business performance as investors might decide to replicate the fund portfolio on their own[26].

3. ASSET CLASSES AND CATEGORIES

Apart from the peculiar features that make ETFs useful and flexible instruments to use for portfolio construction, they differentiate from each other by the asset class they invest in. Investors can choose among a wide range of ETFs categories that add complexity and shades to the asset-selection process.

The most common segment is constituted by equities: they represent almost the 80% of all the listed ETFs, replicating either total market indexes, small industry sectors or a halfway between them. Fund managers can apply different methods to select the shares to include in the portfolio.

[24] Bond, commodity, leveraged and generally ETFs investing in less liquid assets pay out more capital gains than the average.
[25] When fund investments diverge from its stated objective, strategy or style.
[26] Hill et al, 2015.

They may decide to select them by company size, distinguishing from large to medium or small capitalization firms, focus on value stocks (rationally identified as undervalued stocks) rather than growth stocks (those expected to overtake market average growth rate), or restrict to firms belonging to a specific sector. Not less important is the choice on how to distribute shares weights inside the portfolio. Companies can be held proportionally to their market cap with respect the total capitalization of a list of selected securities or be part of an equally-weighted portfolio, to overcome the problem of top-heavy portfolios[27].

In this regard, alternative weighting schemes have been growing in recent years, commonly called "smart beta" strategies. Managers employing them use screening methods and weighting rules based on firm factors, fundamentals, dividends or other attributes believed to drive investment returns in order to obtain higher risk adjusted returns. Invesco Powershares accounted that, from 2010 to 2015, ETFs using smart beta strategies gathered about 21% of US equity ETFs inflow[28]. They represent a cheaper alternative to active investment strategies to employ factors in order to seek lower volatility or enhanced returns. A survey conducted by Cerulli Associates shows that almost two-thirds of the advisors using "smart beta" ETFs have shifted from active mutual funds[29].

The creation of Fixed Income ETFs opened the doors to small investors to institutional-level bond portfolios, before accessible mostly OTC and consequently exposing the retail client, in general interested only in little quantity of individual bonds, to expensive bid-ask spreads. Fixed income ETFs are usually passively managed, tracing bond portfolios with specific exposures on different currencies, geographical areas, credit qualities or maturities

Investing in commodities has been made smoother as well. Previously, investors were required to get involved in futures contracts in order to get exposures to these assets and maintain some margin with the broker according to the commodity price movements. Nowadays, they can simply buy shares in one of the more than 100 commodity ETFs available in the market, ranging from single-commodity funds provided with the physical underlying asset or futures based.

ETFs expanded their investment range also to currencies with the first currency ETF born in 2005. Up to now only 23 new ETFs have been created for this segment, making this asset class niche

[27] Hill et al, 2015.
[28] Hill, Nadig, and Hougan, 2015.
[29] Small, Cohen and Dieterich, 2018.

quite young. Investors can choose among 9 single-currency funds, six basket-currency and other leveraged and index currency ETFs.

Alternative ETFs represents the most peculiar category. They offer good alternatives instead of investing in hedge funds and are divided mainly in two categories. Absolute returns funds, which aim to obtain appealing return in comparison to their downside risk and without a traditional security-based benchmark, and tactical funds Those types of funds offer diversification and hedging opportunities to investors. In fact, they are usually employed to reduce portfolio volatility and to optimize risk management[30].

Finally, ETFs allows investors also to bet against a specific asset or, on the contrary, to multiply the performance of the underlying. These are called respectively inverse and leveraged ETFs. Most of them reset every day i.e. they set a new objective on a daily-basis and consequently are not designed for buy-and-hold strategies. In fact, their performances can widely differ from the one of the index, currency or commodity they track for longer time periods[31].

Table 1 shows inflows and AUM in European ETFs divided for categories as in July 2017. As anticipated, equity ETFs gather together the biggest share of the market, representing the 65% of the total ETFs AUM in Europe, followed by fixed products with 23%. On the other hand, other categories are showing stronger growth: money market ETFs, i.e. those funds providing more stability and safety to investors' portfolios because investing in cash equivalents or short-term highly rated securities, reported a growth rate of 46% from beginning of 2017 to July of the same year, convertible ETFs, offering exposure to both preferred stocks and convertible bonds, showed the second biggest growth scoring 43% in the same period[32].

ETFs inflows diverge also by the strategy applied by the fund manager. In Graph 8, we are not surprised to see that in 2018 most investors decided to direct their money towards index tracking ETFs: 7 out of the 10 biggest funds by inflows are in fact index tracking[33]. Nevertheless, individuals and institutions are showing a growing appetite for smart beta ETFs now accounting for the 9,7% of ETFs assets globally, equal to $485 billion and 5 times greater than active, leveraged and inverse funds[34].

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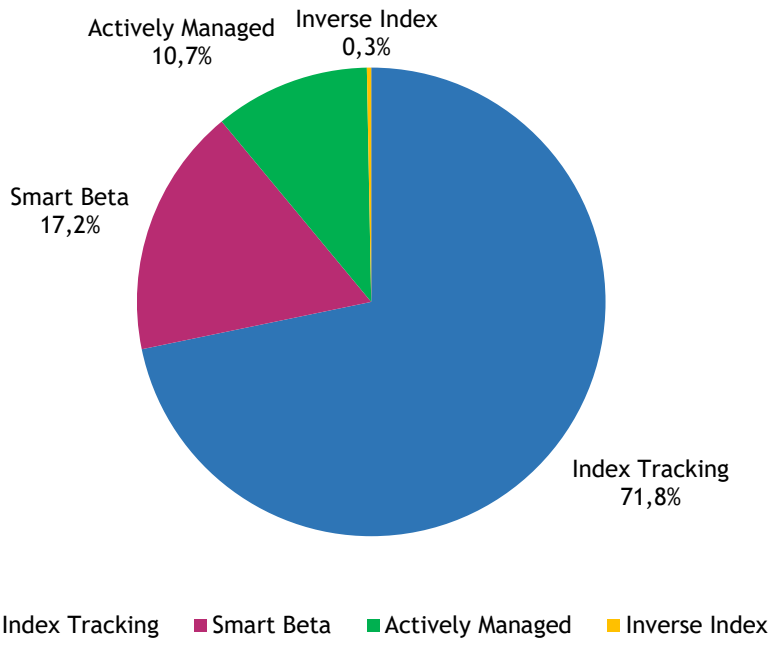
[30] Hill et al, 2015.
[31] SEC, 2009.
[32] Masarwah, 2017.
[33] http://www.etfwatch.com.au/blog/the-etfs-with-the-highest-inflows-in-fy-2018
[34] Ullal, 2018.

Table 1 Flows by Global Broad Category Group on European ETFs

Name	Net Asset in bln€	Market Share%	Estimated Net flow in mln€			Organic Growth Rate%
	July 2017	**July 2017**	**1-Mon**	**YTD**	**1 Year**	**YTD**
Allocation	1	0,10	46	119	123	27,39
Alternative	13	2,07	62	2.783	3.306	26,21
Commodities	48	7,84	671	7,136	8.638	16,62
Convertibles	1	0,10	(0)	193	137	43,00
Equity	403	65,70	4.872	37,560	55.318	10,56
Fixed Income	144	23,44	1,552	16,137	17.027	12,29
Miscellaneous	0	0,07	4	(49)	5	(9,30)
All Long Term	**609**	**99,33**	**7.206**	**63,879**	**84.555**	**11,79**
Money Market	4	0,67	594	1,338	706	46,56
Total	**613**	**100**	**7.800**	**65.217**	**706**	

Source: Morningstar Direct., 2017.

Graph 8 2018 ETF Inflow by Management Type



Source: ETF Watch, 2018.

4. Creation and Redemption Mechanism

The most unique feature of ETFs is perhaps the process through which shares are created and redeemed. We can distinguish two markets for ETFs transactions: primary and secondary market.

Authorized participants (APs) are the only characters in the market able to create and redeem funds shares, they are mostly market makers i.e. large brokers or dealers who entered in a legal contract with the ETF sponsor to take part to the process. As individual investors relate with the mutual fund firm, so APs interact with the sponsor to create (or redeem) new shares in the first market level.

As we already said, ETF managers disclose daily their portfolio composition that is called "creation basket". In fact, apart from being used to determine the NAV of the fund during the trading day, it represents the exact securities that APs need to deliver, in the right percentage, to the ETF in order to get funds shares. ETFs usually requires the AP to enter in large blocks transactions of 50.000 creation (or redemption) units, some funds might ask for a greater number of shares though. Creations and redemptions take place only at the end of the trading day[35].

To this purpose, it is worth noticing that this process can be realized in two different ways, depending on the replication method used by the ETFs. Physical ETFs aim to track the underlying index by owning either all the index stocks or a representative sample of that. On the other hand, synthetic ETFs replicate their underlying using derivatives as total return swap contracts. Intuitively, the former will usually execute shares creation and redemption in-kind while the latter in-cash[36].

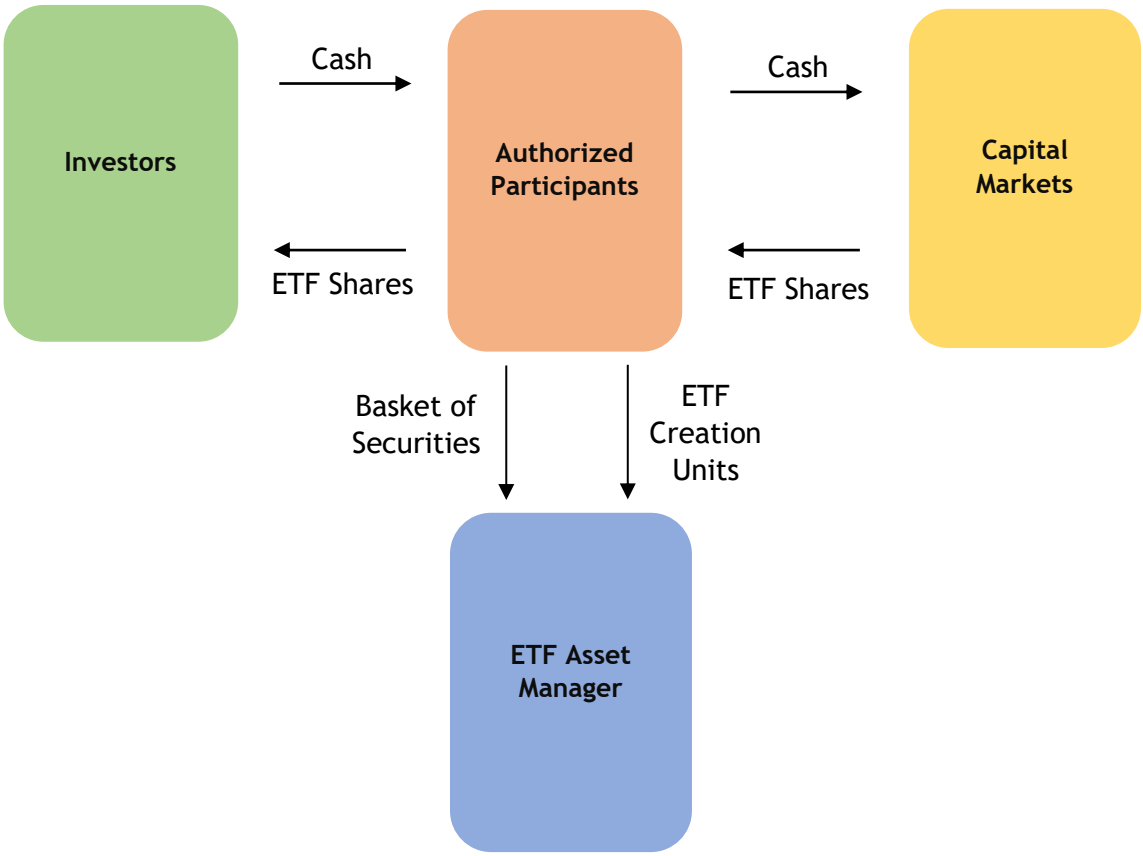
Once shares are created, APs can sell them publicly on the market, this creates the second market level. Investors in ETFs do not enter in direct transactions with the fund, they interact with each other in the global exchange through a broker to sell and buy shares, as dealing with common stocks. As a consequence, ETFs stocks price in this market layer is determined by the supply and demand and there are no trades involving the underlying, causing a reduction in transaction fees compared to when shares transactions are made directly from the fund[37].

As we just said, ETFs shares price is determined by market forces, so it can sometimes diverge from its NAV creating arbitrage opportunities for both APs and investors in both market levels. Market participants can monitor ETF market price as well as its INAV[38] during the day and take

[35] David, Franzoni, Moussawi, 2012; Hill, Nadig, and Hougan, 2015.
[36] David, Franzoni, Moussawi, 2017
[37] David, Franzoni, Moussawi, 2012; Lettau and Madhavan, 2017.
[38] Intraday Indicative Net Asset Value of the ETF basket. It's computed every 15 seconds during the trading day.

advantages of the mispricing. This process is vital to grant ETFs prices to be close to their fair values i.e. the value of the securities they hold[39].

Figure 1 The ETFs Architecture



Source: Lettau and Madhavan, 2017.

The arbitrage gap can however be different among funds, depending on the liquidity and volatility of the underlying and relates costs[40].

When ETFs are sold at a premium with respect to their basket value, APs step in to buy the exact creation basket in the market. This is possible since ETFs sponsor are required to disclose the underlying securities daily. They will consequently deliver them to the fund in exchange of ETFs shares and finally sell the new supply in the open market and pocket the difference. The process

[39] David, Franzoni, Moussawi, 2012.
[40] Hill, Nadig, and Hougan, 2015.

will put upward pressure in the basket securities price and so the intrinsic fund value, while pushing the market ETF price down reducing the premium. On the contrary, when ETFs market price is lower then their fundamental values, arbitrageurs in the primary market are encouraged to buy ETFs units in the market, redeem them to the fund sponsor in order to get the redemption basket securities and sell the latter in the open market. This mechanism will cause positive pressure on the ETFs market price and negative on the ETFs NAV, re-stabilizing the equilibrium[41].

Arbitrage activity can also take place in the secondary market without involving APs activity since both the ETF shares and the underlying securities are continuously trades in the market. Retail and institutional investors will be keen to short sell the most expensive between the two and buy the cheapest one, holding the position until the prices converge. This type of activity is not completely risk-free though, some securities could not be available to short sell, orders execution could not be instantaneous, or the prices discrepancy could persist more than expected[42].

5. DRIVERS IN ETFS GROWTH

Many authors investigate the reasons for the explosion in ETFs investing in the recent years. The peculiar characteristics of these investment vehicles, together with a changing investments management industry, are pushing their expansion and researchers are expecting in the next five years to see the sector growing faster than it has been doing in the past 25 years.

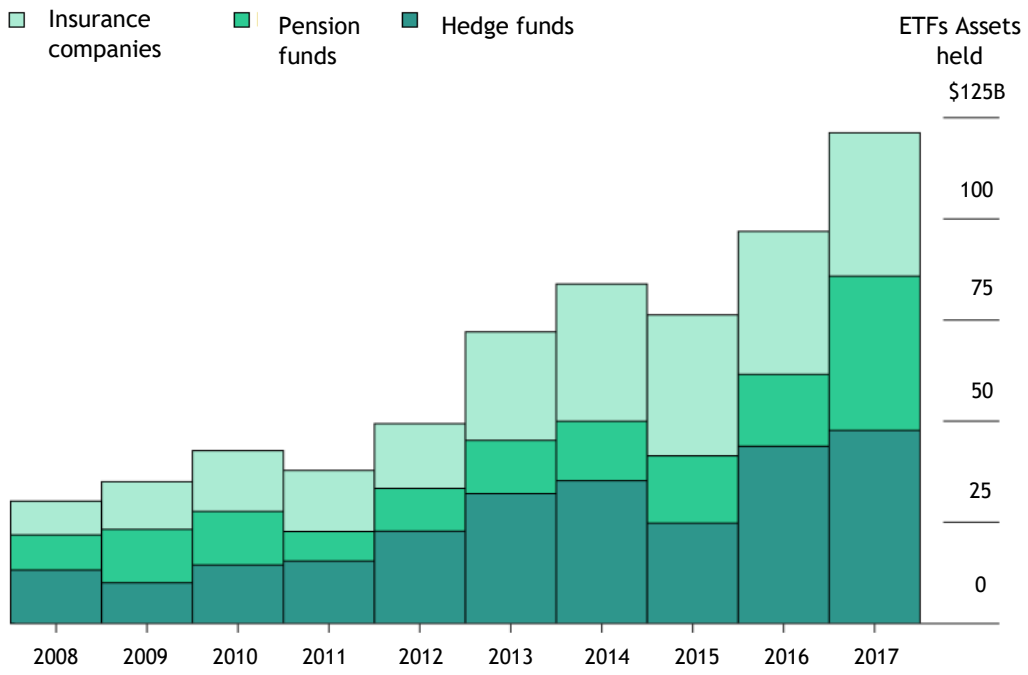
Liquidity, transparency, differentiation and low cost make ETFs perfectly suited for being used as building-blocks in global market portfolios. Indeed, it's important to notice that the "passive" label with which we often refer to these instruments concerns the investment approach used by the fund manager, end investors strategies can differ. More precisely, BlackRock sustain that as the benefits of asset allocation are being recognized as superior to the individual security selection, investors are and will be using ETFs not only to pursue passive investing, but to perfectionate their active investment strategies. They offer to investors efficient ways for portfolio diversification, allowing them to invest in bonds, equities and commodities with different exposures or to use them as trading instrument, for buy-and-hold or strategic asset allocation[43].

[41] David, Franzoni, Moussawi, 2012; Hill et al, 2015.
[42] Lettau and Madhavan, 2017.
[43] Small, Cohen and Dieterich, 2018.

Approximately 39% of asset allocation strategies are found to involve ETFs and, as it is shown in Graph 9, both US and European institutional investors are increasingly employing them to hedge or adjust their tactical positions in addition to their long-term holdings. As an example, almost the 50% of institutions using futures to gain wide exposure have declared to have started replacing derivatives positions with ETFs due to their simplicity and low cost. Given that the 50% of US ETFs is held by institutional investors and the shares in the European industries skyrockets to 80%, it's not surprising the positive influence that these actors have in the sector growth[44].

As we have already highlighted before, the low fees associated with passive funds have been one of the main drivers of the increasing interest in these instruments by investors, mainly caused by the common idea that stock-picking costs eventually erode long-term returns and the same applies to ETFs. In fact, retail and institutional investors as financial advisors' choices have become particularly cost-oriented in the recent years given the low performance of actively managed funds, that haven't justified their higher price. Moreover, technology innovations and the proliferation of analytical tools have created tougher competition on a cost-basis point of view so that, in 2017, fund investors in US have paid the lowest amount in total expenses ever[45].

Graph 9 Institutional ETFs Ownership



Source: Deutsche Bank Delta-1 and Quant Strategy, Factset, 2017.

[44] Ramaswamy, 2011; Evans and Wilson, 2018.
[45] Small, Cohen and Dieterich, 2018.

The choice of ETFs is driven also by the ongoing transformation in the financial advisory industry. In fact, advisors are shifting from a compensation-based to a fee-based business model: an increasing number of them is now applying commissions on the total assets managed, instead of being paid for each security bought by clients. The adoption of this model has been prompted both by new regulatory frameworks, aimed to face conflicts of interests with investors and to increase transparency, and the use by big US wealth managers. As an example, from 2013 to 2017, Morgan Stanley declared that the proportion of fee-based assets in the total assets of wealth management clients, rose from 37% to 44%. In Europe, the implementation of MiFID II in 2018, has required a higher grade of disclosure on fees and retrocessions applied by funds, banks and advisors[46].

Moreover, investors are now seeking more efficient and simple ways to trade bonds. This market has always been quite old fashioned, involving over-the-counter purchases and sales done by phone and now that institutions are dealing with increasing difficulties in accessing individual bonds, bonds tracking ETFs represent a cheaper alternative: US high-yield bond ETFs usually trade with a bid-ask spread of approximately 0,01%, on the other hand investors dealing with the underlying high-yield bond will face costs ranging from 0,5% to 0,85%. In addition, we need to consider the additional liquidity provided by these instruments to the bond market given that investors are able to offset each other positions without being obliged to trade the underlying security.

ETFs trading activity has been observed also to get heavier when shock events or policy changes happen, potentially gathering together more volume than the local market does. In 2015, during the Greek sovereign debt crisis, ETFs have been representing an escape route for investors when local exchanges shut down. Similarly, in June 2018 BlackRock ETF tracking the Brazilian market registered almost as much activity as the Brazilian index Ibovespa, after the political turmoil caused a general stocks sell-off; again, in September 2018, when Turkey has been subjected to US economic sanctions, investors toke short positions on Turkish companies through the BlackRock Turkey ETF that experienced its largest inflow in 5 years[47].

New changes have been re-shaping the financial industry in the recent years. More efficient information vehicles, new regulatory frameworks, index proliferation and new automated investing platforms are pushing investors to favor lower-cost investment opportunities, slowly shifting away from an active funds industry that has been failing to beat the pre-fixed benchmark once fees are

[46] Small, Cohen and Dieterich, 2018.
[47] Evans and Wilson, 2018.

deducted. It comes with no surprise that passive investing has been experiencing growing inflows, mainly due to the lower and decreasing expense ratios resulting from the high concentration of providers, the absence of thorough market research and the higher cost transparency asked by regulators. Among all the passive instruments to investors disposal, ETFs have captured the greatest interest not only for their cost efficiency but also for their intrinsic characteristics. These funds are creating a transparent level-playing field for all investors giving an indiscriminate access to markets that were before inaccessible both for liquidity and cost issues. Analysts see big growth potential in ETFs and are expecting to see the industry more than doubling, becoming 12$ trillion worth by 2023[48].

[48] Small, Cohen and Dieterich, 2018.

II. FROM INFORMATION ENHANCEMENT TO NOISE PROPAGATION

The increasing popularity of ETFs, together with their creation and redemption mechanism and arbitrage activity, are arising concerns on the potential threats they can represent for financial stability. We need to remember that, even though ETFs are classified as passive securities, they are employed by investors in active strategies: their global size is still no comparable to the most traditional investment products, but their trading volume does, with the SPY being the most traded security. In 2016, ETFs counted for almost the 42% of the US trading by value.

In this chapter we are going to analyze the consequences of ETFs trading on the underlying securities pricing investigating on the conflict between price discovery potential and non-fundamental shocks propagation, the effect on the underlying assets liquidity and volatility, the tendency to returns commovement among assets and the systemic risk triggers.

1. PRICE DISCOVERY POTENTIAL

As we explained in the first chapter, ETFs add a layer of liquidity on the underlying assets thanks to the continuous arbitrage activity performed by the APs. This additional trading level has two different consequences on their securities basket: on one hand it can make pricing more efficient enhancing the spreading of information; on the other, when non-fundamental shocks affect ETFs performance, they can propagate to the underlying securities causing mispricing.

When we talk about price discovery, we refer to the detection of securities fair value through the trading activity: it translates into the fund correct valuation of the underlying portfolio when talking about ETFs. In fact, even though the mimic mechanism should be the other way around, being the ETF replicating the securities prices, investors might prefer to use them to make directional bets on the underlying given their greater liquidity and modest cost, thus including new asset information directly into the ETF price. In their turn, both APs and arbitrageurs exploit the gap between ETFs and their portfolios values to profit, ensuring the two prices to converge and resulting in a systemic transmission of the new information from the ETF to the mimed portfolio[49].

[49] Borkovec, Domowitz, Serbin and Yegerman, 2010; Mhadavan and Sobczyk, 2016; David, Franzoni and Moussawi, 2017.

Precisely, some studies have observed that investors are prone to use ETFs to overcome short-sale constraints on the underlying stocks creating a predictive potential of future stocks returns based the activity of the ETFs tracking them. It is shown that, when the short-selling demand for one security and the cost to achieve that are high and its lending supply low, the ETF short ratio including it tends to soar; low liquidity and high volatility in the underlying enhance this relationship.

While some traders are interested in shorting the ETF as a whole, gaining negative exposure on one sector, industry or a set of assets, because they believe the instrument will negatively perform, other investors use them to create synthetic short position in one or more of their constituents. By shorting the ETF and hedging its underlings but the asset they have negative expectations of, they are able to create this latter bearish exposure. It follows that, if this theory holds, we should be able to extract some reliable information about future negative stock performances when one asset is found to be the target of several ETFs' short bets.

To this purpose, Li and Zhu constructed an ETF-based short ratio for a sample of stocks, collecting the overall short demand for a specific security through the short interest in the ETFs holding it. Through a Fama-MacBeth multiple regression model they find evidence that ETFs short selling contains additional negative information on its constituents not included in the price of the latter. Moreover, when variables indicating greater difficulties in short-selling are included in the analysis, the ETF-based short ratio predictive power of the stock negative returns results intensified for those with tougher short-sale restrictions. The explanation relies in the fact that sometimes the actual demand for an asset short-sales is not fully revealed by the market short interest in that security because of constraints on the equity-lending market, creating some market friction to a correct asset pricing. The two authors finally conclude that ETFs eventually help to enhance market efficiency since they create a window on future stock returns[50].

Other evidences are consistent with ETFs price discovery potential, mostly when the markets of the underlying securities are illiquid. For example in 2010, when the US municipal bond market got almost totally frozen, investors have been able to keep trading those instruments through ETFs, which were representing the only source of liquidity for that market. Similarly, during the Arab Spring in 2011 the Egyptian stock market closed; ETFs tracking it kept trading though, providing a way for investors to see what the market expectations were[51].

[50] Li and Zhu, 2016.
[51] David, Franzoni, Moussawi, 2017.

A natural question now is to wonder when price discovery ends, and mispricing begins inside the ETFs prices premiums (or discounts) with respect to their portfolios value. Mhadavan and Sobczyk developed a model to decompose the price gap into these two elements. The distinction plays an important role for investors' strategies since they might avoid buying at a premium, or selling at a discount, when the ETFs price has moved for an actual shift of its intrinsic value.

The two authors developed an 8-parameter model and applied that to 947 US-domiciled equity and fixed income ETFs in a time frame going from 2005-2014. To show how the model can be applied to investigate the true nature of the observed mispricing, they applied the model to the iShares iBoxx High-Yield Corporate Bond ETF (HYG) during the 2008-2009 Financial Crisis. ETF price and NAV are observed to move together until 2008; after this moment, in September 2008, a plunge in the ETF price led to a strong increase in the price discount with respect to NAV, showing the presence of staleness in the latter. Markets start recovering in March 2009 and an increase in the price influences positively the NAV. To understand the reason of the mispricing then, a regression of the estimated premiums against the observed ones is conducted. This results in a yield slope of 0.47, meaning that, during the analyzed 2-years period, almost half of the mispricing is due to price discovery[52].

Mhadavan and Sobczyk define the price discovery component as the percentage of the total variance that is not caused by transitory noise shocks. Table 2 reports the estimated statistics for the price discovery element for both Equity and Fixed Income ETFs, distinguishing domestic from international funds and splitting them by different sizes of funds AUM (in a range where 1 are the largest and 5 are the smallest). We can see that the general components of the mispricing vary with respect to the asset class, the exposure and the size of the ETF: on one hand, small and less actively traded ETFs present a lower price discovery element, meaning that more than a half of their price gap is due to non-fundamental reasons, on the other the 74% of the premium (discounts) variation of big international equity funds is explained by the price discovery component. This confirms the intuition of the two authors: for the biggest and most common funds in terms of trading, the gap between NAV and ETF price is mostly a reflection of staleness in the first i.e. NAV pricing error.

[52] Mhadavan and Sobczyk, 2016.

Staleness in the NAV arises when this is not able to capture the actual and fair valuation of the ETF components. In these cases, the volatility in ETFs returns will be higher than the one of the underlying portfolio NAV. Significant mispricing can arise when there is a lag in the adjustment, particularly during market stress[53].

Table 2 Estimation of Price Discovery Component

Asset Class	Exposure	AUM Quintile	Number of Funds	Total AUM ($MM)	Price Discovery Component (D)
Equity	Domestic	1	78	801,146	0.59
		2	78	64,815	0.49
		3	77	19,804	0.41
		4	77	5,940	0.32
		5	77	1,099	0.29
	International	1	81	347,338	0.74
		2	81	26,107	0.64
		3	81	6,541	0.53
		4	80	1,674	0.43
		5	80	360	0.25
Fixed Income	Domestic	1	23	162,123	0.55
		2	23	18,958	0.40
		3	23	7,230	0.50
		4	22	2,409	0.46
		5	22	520	0.45
	International	1	9	18,077	0.31
		2	9	2,556	0.33
		3	9	987	0.50
		4	9	306	0.22
		5	8	73	0.17
All Funds			**947**	**1,488,063**	**0.46**

Source: Mhadavan and Sobczyk, 2016.

Finally, to examine the behavior of ETFs pricing throughout the crisis, in a period of high market stress and liquidity shortage in the securities basket, the model has been applied during and post the financial crisis, the first period ranging from 2008 to 2009 and the second from 2010 to 2014. The results show that NAV staleness coefficients have higher values during the crisis for fixed-income ETFs, probably reflecting a freezing in the trading activity, and arbitrage speed parameters

[53] Mhadavan and Sobczyk, 2016.

are instead smaller. This could suggest that, particularly for less traded assets such as fixed income securities, the price discounts to NAV during financial shocks reflects efficient pricing, bearing in mind that ETFs price dynamics are always driven by their intrinsic arbitrage activity[54].

2. EVIDENCES OF NON-FUNDAMENTAL SHOCKS PROPAGATION

As opposed to the view of Mhadavan and Sobczyk, other academics focus on the potential transmission of non-fundamental shocks from the ETF to the underlying stock through arbitrage, given that arbitrageurs take opposite position in the fund and its components[55].

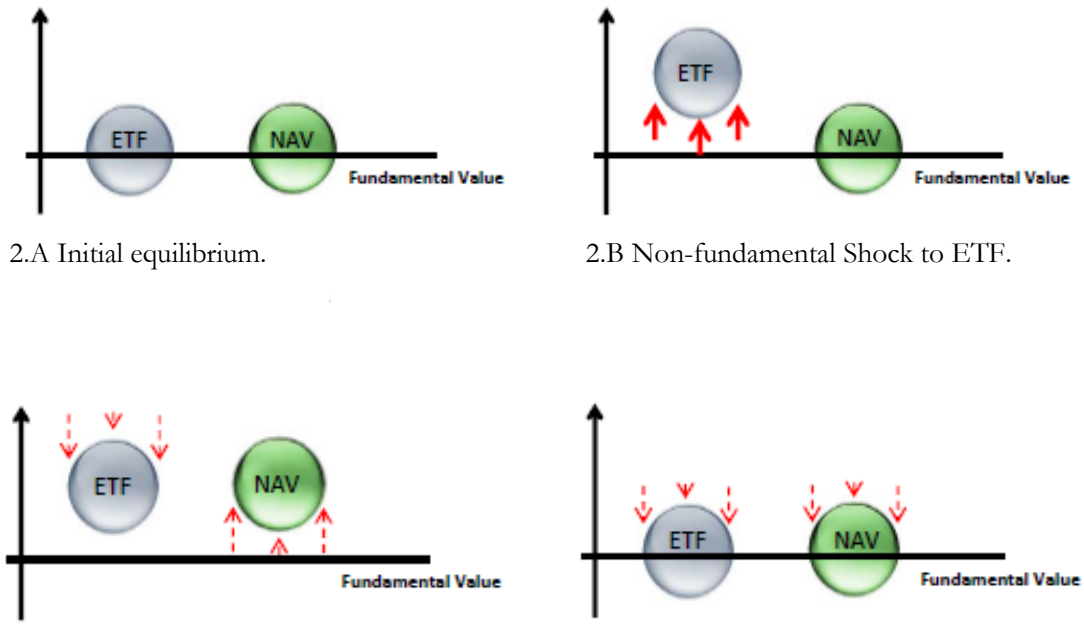
To study the impact of ETFs on financial markets, Malamud has created an equilibrium model that makes it possible to analyze the ETF universe as a whole by allowing for any number of ETFs and correspondent components. It pictures the creation and redemption mechanism as a shock-propagation channel that, combined with APs' arbitrage activity might create momentum in the underlying assets returns and consequently lead to financial instability by reflecting temporary demand shocks on future prices[56]. The requisite for this noise propagation is the presence of an ETFs demand shock[57].

If market would be efficient, we would expect the ETF price and its NAV to perfectly converge, as reflections of the same exact fair value but unfortunately financial market has proven several times not to be perfect. The continuous creation and redemption of new shares facilitates arbitrage though, so that the two prices are not expected to diverge substantially. However, in the recent years, ETFs have been increasingly employed for hedging and speculative aims that expose these instruments to non-fundamental shocks. To this purpose, I. Ben-David, F. Franzoni and R. Moussawi exemplify the propagation of shocks from the fund to its portfolio as follow. We imagine an initial situation where neither premium nor discount exist between the ETF price and its NAV, i.e. they have the same value, as shown in Figure 2.A. At one point, we suppose an exogenous liquidity shock not based on any fundamental reason happens, for example a boost in the ETFs

[54] Mhadavan and Sobczyk, 2016.
[55] Da and Shive, 2017.
[56] Malamud, 2015.
[57] David, Franzoni and Moussawi, 2017.

shares demand by a large institution, positively influencing the ETF price (Figure 2.B). Arbitrageurs suddenly steps in to take advantage of the mispricing, betting on the realignment of the two prices by going short on the ETF and taking a long position in the underlying portfolio. This mechanism triggers the shock spreading, making the price of the underlings increase (and consequently the ETF NAV) and, at the same time pushing downward the ETF price as in Figure 2.C, until the equilibrium in re-established. Eventually, the liquidity inflows received come back to normality and both prices revert to their fair values, shown in Figure 2.D.

Figure 2 Non-Fundamental Shock Propagation



2.A Initial equilibrium.

2.B Non-fundamental Shock to ETF.

2.C The non-fundamental shock is propagated to the NAV through arbitrage, the ETF price starts reverting to the fundamental value.

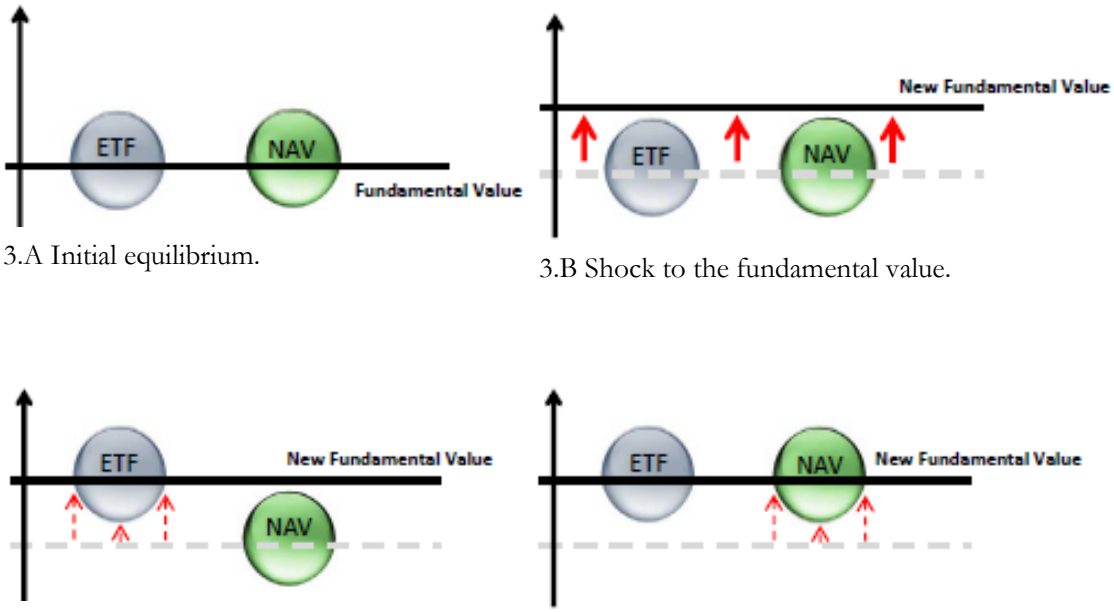
2.D Re-establishment of equilibrium after some time, both the ETF price and the NAV revert to the fundamental value

Source: David, Franzoni and Moussawi, 2012.

As we explained before, when ETF price experiences a shift with respect to its fundamental value we can't exclude the price discovery potential it bears. In fact, if the initial shock was happening for a fundamental reason, ETF NAV would be moved by the same price-contagion as it is shown in Figure 3. The initial equilibrium is broken by a shock in the fundamental value of the fund portfolio; as mostly happens, the ETF market is more liquid with respect to its underlying market

so it comes with no surprise the chance of it making the first step towards the new fair value and its NAV moving with a delay[58].

Figure 3 Fundamental Shock with Price Discovery Occurring



3.A Initial equilibrium.

3.B Shock to the fundamental value.

3.C The ETF price moves to the new fundamental value.

3.D After a delay, the NAV catches up with the new fundamental.

Source: David, Franzoni and Moussawi, 2012

Given this potential, it's necessary to demonstrate that the shock triggering the mispricing with respect to the NAV comes from a non-fundamental initial shock. To do so, the authors decided to create two further constraints: firstly, they show that the mispricing impact of a shock on the NAV is short-lived, according with the fact of the shock being non-fundamental, secondly, they expect the demand pressure on the ETF to not match the one on the underling portfolio.

Moreover, it's essential to demonstrate that the underlying security wouldn't be hit by the shock propagation with the same intensity in the absence of ETFs, since we are trying to identify their inner arbitrage activity as a shock-propagation channel. For this reason, the three authors reported evidence that these funds, given that they provide low cost liquidity, attract short-term investors

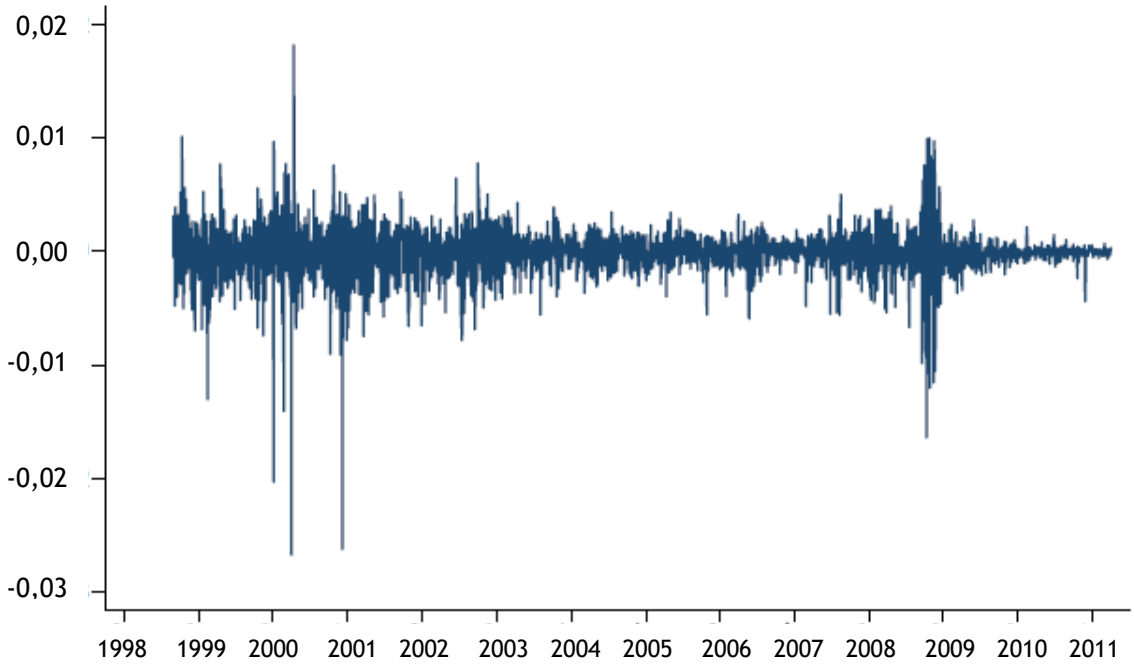
[58] David, Franzoni and Moussawi, 2012.

who enhance the possibility for liquidity shocks to happen and they access indirectly the underlying components through the ETF intermediation.

To test their hypothesis, David, Franzoni and Moussawi used a sample of 1.146 ETFs in a time frame going from September 1998 to March 2011. The fundamental measure used as ETF arbitrage profitability is the mispricing i.e. the difference between ETF price and its NAV.

It's quite straightforward to look at the behavior of the daily percentage mispricing observed in the SPY during the analyzed period, showed in Graph 10. First, we notice a gradual shrinking in the gap between the two values, probably as a reflection of increased liquidity in the ETF market (due to increase AUM over time) and consequent lower transaction costs which made ETF arbitrage more convenient. Second, the mispricing increases during period of market stress as the 2008-2009 financial crisis showing an intuitive relation with the overall market liquidity: lower levels of liquidity might be a symptom of lower funding liquidity that in turn implies a reduction in the capital invested in the ETF and make arbitrage less convenient as the transaction fees get higher.

Graph 10 Daily Percentage SPY Mispricing 1998-2011



Source: David, Franzoni and Moussawi, 2012.

To support the "clientele effect" assumption, the authors need to demonstrate two subsequent phenomena. In the first place, ETFs ownership needs to show a decrease in the investors trading

horizon than the ones investing in common stocks. Using the churn ratio of institutional investors[59] as proxy for ETFs investors turnover, they find evidence that the average turnover of these funds investors is in fact higher than the normal stocks. Then, they investigate on the effect of ETFs ownership on the stock-level investors turnover and their results support the conjecture that ETFs increases arbitrage activity between them and their underlings, consequently attracting shorter-time horizon investors.

Now, focusing more on the shock propagation potential, we need to find a significant relationship between the ETF mispricing and the movement in the NAV. In fact, if ETFs are representing a channel for shock transmission to their underlings through arbitrage activity, we expect the ETFs fundamental value to move in the same direction of the mispricing i.e. if positive investors are expected to start buying the underlying and selling the ETF, if negative all the way around. In order to test this hypothesis, a regression of a NAV day-t return against the mispricing in day-t-1, with other control variables as date fixed effect has been made. The results are in line with what expected: independently from the fund fixed effect control, the NAV return has a positive coefficient with respect to the mispricing variable; in particular, a 1% gap between the ETF price and its fundamental value is associated with an increase of 16 bps increase in the next-day NAV daily return.

As we explained above, we also expect the arbitrage activity to cause a movement in the ETF price exactly opposed to the mispricing. For this reason, the authors decided to regress ETF returns against the prior day mispricing. Again, the negative coefficients support the conjecture and they have a greater magnitude than the previous regression: a mispricing in day-t-1 will cause both the fundamental value and the price of the ETF to move in a direction consistent with closing the gap, the latter will move faster though, probably due to higher liquidity in the ETF market and to a greater sensibility to liquidity shocks in comparison to the underlying market.

Finally, we need to rule out mispricing hasn't been caused by fundamental shocks. If not, it would mean that the ETF arbitrage activity would only be beneficial as a channel for price discovery. To do so, the authors developed two more constraints: if the shock is non-fundamental, we first should expect a reversal in the fundamental value during the following days as liquidity is expected to flow

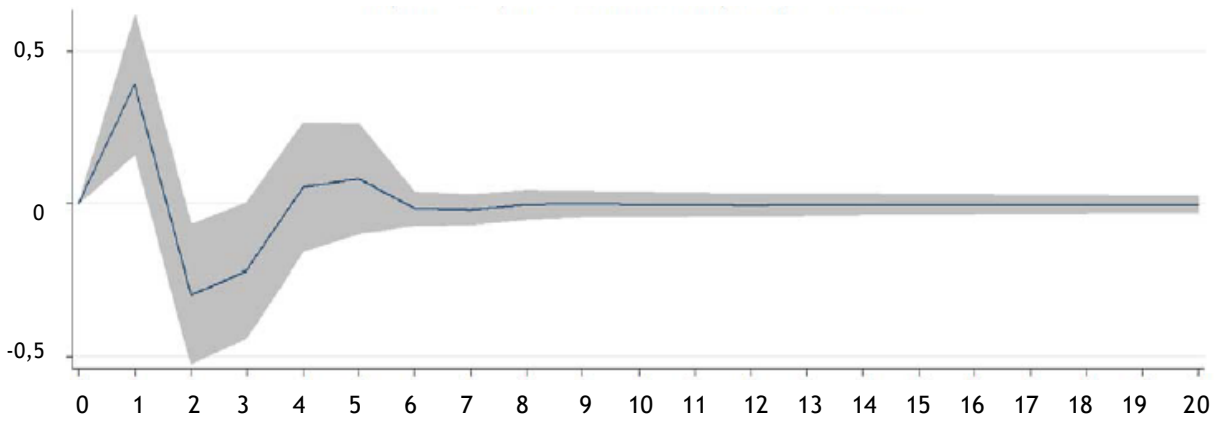
[59] Computed as the sum of quarterly absolute changes in dollar holdings over average assets under management.

back to a normal level.; second, the demand for the ETF should diverge from the demand of its component when the shock hits the fund market only.

The vector auto-regression analysis is applied both to the NAV returns as a function of lagged mispricing and NAV returns up to the 5th lag in order to investigate the length of the mispricing impact on the NAV. The mispricing is observed to positively influence the fundamental value of the ETF in the first lag. However, the NAV is negatively correlated with the mispricing when we move to further lags. In particular, the authors noticed that the magnitude of the negative correlation with the second lagged mispricing counterbalance the effect of the first i.e. the effect of the initial shock, going from the ETF price to its NAV, is reverting on the second day.

Graph 11 replicates the behavior from the regression coefficients. It shows that, a shock to the ETF price on day 0, that translates into mispricing, positively impact the NAV returns on day 1 but it's counterbalanced by opposed movement on days 2 and 3.

Graph 11 Impulse Response Functions of a Shock on Future NAV Returns.



The grey bars represent two standard errors around the estimates.
Source: David, Franzoni and Moussawi, 2012.

Then, to investigate about the discrepancies between buy and sell pressures between the ETF market and its components, in order to identify non-fundamental shocks, the authors compare the buy-sell order imbalance (OI) of the two markets. When the OI is positive there will be pressure exercised by the bidding side, on the other hand, when negative there will be selling pressure. The OI is computed daily for the ETF market, the measure is calculated as the value-weighted daily OI of the assets composing the fund for the underlying portfolio instead. The main assumption made by the authors is that, large OI in the ETF market not matched in the underlying securities are

synonym of a demand shock affecting only the former level and being consequently non-fundamental.

First, large OI dummies are used in the first stage of a two-stages least squares regression in order to identify the existence of a significant relationship between demand imbalances and mispricing. The resulting coefficients shows that the gap between the ETF price and its NAV is positively (and negatively) related respectively with positive (and negative) buy and sell imbalances and the effect seems to be symmetric. The authors then use those estimates as proxies for mispricing in the 2SLS second stage regression, where the dependent variables are the NAV returns and the ETF return respectively, at t+1. The results show consistency with the OLS that previously has been applied: the mispricing component originating from non-fundamental shocks in the ETF market propagates the latter to the underlying securities level. Finally, the same OLS regression is applied only to those observations which OI indicator equals 1. Again, the predictability is found to be similar to the evidence we obtained from the whole sample.

The results obtained by David, Franzoni and Moussawi's study support their theory, showing that arbitrage activity is not only helping to keep the ETF price and its NAV aligned but it can represent a risk for financial markets since it has the potential to move the price of correctly-valued securities and consequently causing noise transmission and volatility in the underlings included in the ETF portfolio[60].

3. ETFs as Noise Spreaders into the Underlying Securities Market

In 2015, David, Franzoni and Moussawi carried out one additional study, investigating the effect of ETF on the volatility of the securities comprised in their basket. In particular, they interrogated whether the prices of securities owned by a high number of ETFs display greater noise in the prices and their behavior tends to differ from a random walk. Since they represent the wider category, the analysis is focused on plain vanilla ETFs that physically track US stock indexes.

They begin by demonstrating that ETFs are mostly held by noise short-term investors due to their greater liquidity with respect to their components. To investigate on these liquidity differences, they collected some statistics regarding the bid-ask spread percentage, the Amihud measure of price

[60] David, Franzoni and Moussawi, 2012

impact[61] and the daily turnover. For all the 660 US-Equity ETFs listed on the US Stock Exchange[62], each of the three measures is computed as the average of all the assets in the fund portfolio, on a quarterly basis, and subsequently, the value-weighted mean is calculated according to the market capitalization of each ETF. As we can see in Table 3, all the three measures prove that the ETF market is more liquid than the related underlying securities: narrower bid-ask spread, smaller Amihud ratio and higher daily turnover.

Table 3 Liquidity measures

Variable	**Quarters**	**ETFs**	**Stocks**	**Difference**	**t-stat**
Bid-Ask Spread	52	0,003	0,005	-0,002***	(-3,518)
Amihud Ratio	52	0,002	0,008	-0,006***	(-9,702)
Daily Turnover	52	0,093	0,011	0,083***	(-13,462)

Source: David, Franzoni and Moussawi, 2015.

Following the Amihud and Mendelson's clientele effects[63], as in their precedent study, which states that short-term investors are more interested in investing in financial instruments with higher liquidity, they find out ETFs investors turnover to be 6.7% higher than their underlying portfolio.

Finally, the marginal investor of the ETFs sample is analyzed in comparison with the ownership of all the common stocks accounted by the CRSP[64]. What is discovered is that not only institutional investors represent a smaller portion (47,4%) of the ETF market than what they do in stocks (62,1%), causing ETF ownership to be more skewed towards retail investors that are more prone to act alike noise traders[65]; but the institutional presence tends to have higher turnover in the ETFs than in the underlying, with hedge funds representing the fastest trading category.

The second hypothesis developed by the authors, and the one pillar of this work, is that ETFs do add an additional level of demand, and subsequently volatility, to the stock market. To demonstrate this proposition, as we anticipated before, they focused their attention on plain vanilla US domestic long equity ETFs in a time frame going from 2000 to 2012. They included only those funds

[61] The ratio of absolute return to the financial instrument dollar volume. This is a proxy for the illiquidity of the instrument, showing the daily price impact of one-dollar trading volume.
[62] As of 2015.
[63] Amihud, Yakov, and Mendelson, 1986.
[64] Center for Research in Security Prices owns one of the largest historical databases in stock research.
[65] Stambaugh, 2014.

investing in US equity stocks market primarily, excluding those investing in physical commodities, futures, international or non-equity securities in general as well as those applying leveraged, short or active strategies. The final sample comprises 660 ETFs listed in the US Stock Exchange.

The existence of a connection between ETFs ownership and the volatility in the underlying basket is firstly tested through an OLS regression. The ETFs ownership of a stock is defined as the sum of the investments values of all the ETFs trading that security, divided by its total market capitalization. The stock volatility, computed as the stock daily returns standard deviation within a month, is then regressed against the variation of ETFs stocks ownership, across both securities and time. Moreover, in order to avoid the potential omittance of spurious variables with returns volatility, different controls have been included. ETFs ownership mainly depends on three factors: a single stock can be comprised in the basket of different indices and, in parallel, those indices can vary their weighting schemes, in addition to changes in the ETFs asset under management over time.

The index weighting strategy is the most exogenous element to our dependent variable. If the weights do not move together with the stock market capitalization though, as in equally-weighted indices, this could create a false relationship between ETFs ownership and volatility caused by the correlation between stock size and volatility. To capture this effect, the logarithmic market capitalization has been included in the regression together with proxies for stock size, liquidity, returns predictors and time fixed effect.

Table 4 reports the results of the OLS regression of the daily returns volatility in a given month against the ETFs ownership for those stocks at the end of the prior month. S&P500 and Russell 3000 stocks are regressed separately to see the variation of the interest depending on the firm size. A positive and significant relationship is observed for stocks of both indices: for every unit of increase (or decrease) in the ETFs ownership SD, the stocks returns daily volatility will increase (or decrease) of about 13,2%, consistently with the authors hypothesis that ETFs add a layer of noise to their underlying basket. Then, we notice that, for smaller stocks i.e. those included in the Russell 3000, the coefficient is lower, between 4,2% and 5,2%, showing a weaker relation.

This phenomenon can be explained with the concept of "optimized replication". To replicate an index, fund managers or investors in general, have two choices: either to fully replicate the index by buying all the securities included in it (full replication) or to buy only those securities in the index

that are the most representative of it for their risk, correlation and exposure (optimization)[66]. As we explained in the first chapter, arbitrage activity when ETFs prices diverge from their fundamental values, can be conducted directly on the second market level without involving creation and redemption activity but only buying (or selling) ETF shares and selling (or buying) the underlying portfolio, waiting for the two prices to converge. Consequently, through optimization, arbitrageurs don't need to invest in the whole ETF basket portfolio, but they can only focus on the larger and more liquid stocks, minimizing the transaction fees, in order to construct the replicating portfolio.

Table 4 ETFs Ownership and Stock Volatility

Dependent Variable	**Daily Stock Volatility**			
Sample	**S&P 500**		**Russell 3000**	
	(1)	(2)	(3)	(4)
ETFs ownership	0,132***	0,127***	0,052***	0,042***
	(4,828)	(4,700)	(4,606)	(3,784)
Log (Mktcap (t-1))	0,048	0,038	-0,096***	-0,116***
	(1,271)	(1,010)	(-3,799)	(-4,550)
1/Price (t-1)	1,574**	1,502**	0,814***	0,905***
	(2,446)	(2,343)	(2,954)	(3,291)
Amihud(t-1)	-9,242	-3,037	0,195	0,305
	(-0,604)	(-0,206)	(0,704)	(1,087)
Bid-ask spread (t-1)	-7,346**	-7,215**	-8,894***	-8,168***
	(-2,085)	(-2,041)	(-2,989)	(-2,723)
Book-to-Market (t-1)	0,531***	0,530***	0,332***	0,325***
	(9,162)	(9,172)	(9,539)	(9,381)
Past 12-month return (t-1)	0,025	0,016	0,056***	0,061***
	(0,668)	(0,430)	(2,791)	(3,051)
Gross profitability (t-1) *	0,454***	0,493***	0,032	0,042
	(4,143)	(4,400)	(0,607)	(0,788)
Index fund ownership		0,028**		0,021***
		(2,287)		(3,537)
Active fund ownership		0,062***		0,060***
		(3,884)		(6,509)
Stock fixed effects	Yes	Yes	Yes	Yes
Month fixed effects	Yes	Yes	Yes	Yes
Observations	67.261	67.261	289.563	289.563
Adjusted R^2	0,645	0,647	0,593	0,595

.***, **, * represent statistical significance at the 1%, 5%, or 10% levels, respectively.
*Gross income scaled by total assets.
Source: David, Franzoni and Moussawi, 2015.

[66] https://www.etf.com/etf-education-center/21038-how-to-run-an-index-fund-full-replication-vs-optimization.html?nopaging=1

Finally, to test if ETFs ownership is capturing more than the effect of the stock ownership by institutional investors, in column 2 and 4, the variables related to the stock ownership by both active and indexed mutual funds have been introduced (being these latter the most similar to ETFs). As we see, the coefficients are still positive but with lower magnitude with respect to the ETFs, which slope remains almost unchanged showing an independent and stronger relationship with stocks returns volatility accordingly with the first hypothesis that ETFs are mostly held by noise traders. As we expected, following what said in the last paragraph, the coefficient for smaller stocks is no more statistically distinguishable with the ones related to mutual funds.

As we considered earlier in this chapter, increase volatility in stock prices is not always connected to pure noise. If the presence of ETFs makes stocks prices to react more promptly to change in fundamental through the arbitrage activity it means that the observed increased volatility connected with these funds stocks ownership, it's no more noise but price discovery. The authors distinguish between fundamental and non-fundamental volatility.

In order to investigate this matter, they conduct a further OLS regression on the variance of ETF ownership, this time using as dependent variable the Variance Ratio, a measure for price efficiency consisting, for every stock *i* at time *t*, in:

$$VR_{i,t} = \left| \frac{Var(r_{k,i,t})}{k * Var(r_{1,i,t})} - 1 \right|$$

where the numerator is the variance of k-period stock returns within a time frame t and the denominator is k times the variance of a single period returns in equal t. When markets are efficient, we expect the ratio between the two variances to approach 1, since prices should behave like a random walk, and so the VR to approach zero. So, if ETFs add non-fundamental volatility to their underlying securities, we should observe an increase in the Variance Ratio of a stock with higher ETFs ownership of that stock.

Since, as already discussed, stock prices can be affected by ETFs arbitrage activity intraday and daily, as arbitrageurs act both in the primary and secondary market, the VR has been constructed with 15-seconds frequency and 5-days frequency respectively. The results are shown in Table 5, the same control variables applied in the previous experiment have been adopted. The evidences point out that a significant and positive relationship does exist between ETF ownership the VR,

being, the behavior of stocks with higher ETFs ownership, departing from a random walk and so including more noise. As we see the link is stronger at the intraday frequency and, consistently with the coefficients in Table 7, smaller stocks are found to be less affected.

Finally, as the authors carried out in their 2012 experiment, we look for a mean-reverting component in the stocks returns as we expect by Figure 2, when a demand shock happens in the ETFs market, we expect the price of the underlying securities to move in the same direction, since the fundamentals haven't change though, the prices should revert to the initial level in the following days.

Table 5 ETFs Ownership and Stock Volatility Variance Ratios

Sample:	**S&P 500**		**Russell 3000**	
Dependent Variable:	**VR 15 seconds**	**VR 5 days**	**VR 15 seconds**	**VR 5 days**
	(1)	(2)	(3)	(4)
ETFs ownership	0,109***	0,049*	0,061***	0,013
	(4,485)	(1,809)	(7,620)	(1,188)
Controls	Yes	Yes	Yes	Yes
Stock fixed effects	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Observations	56.623	22.887	268.418	100.836
Adjusted R^2	0,473	0,032	0,488	0,041

***, **, * represent statistical significance at the 1%, 5%, or 10% levels, respectively.
Source: David, Franzoni and Moussawi, 2015.

To investigate this hypothesis, the returns of the underlying securities, at different and overlapping time horizons, have been regressed against the net flows of creations and redemptions in ETFs made by APs. The values of the securities included in the basket should move according to the ETFs flow no matter if due to fundamental or non-fundamental reasons. Assuming that at least, a part of the initial shock is not justified by a change in fundamentals, we expect a price reversal to happen in the next days. The previous control variables haven't change.

For a one standard deviation change in the net flow, there is a contemporaneous movement of 16.7 basis points in the prices of the S&P 500 stocks. In the next days though, the negative coefficients predict reversion in the stocks prices showing that at least half of the initial impact on returns volatility is caused by noise propagation. Accordingly to the previous experiments, the absolute value in the Russell 3000 stocks is smaller.

At this point, since we found evidences of an existing link between ETFs ownership and underlying stocks non-fundamental volatility one question arises: are ETFs adding a new layer of demand to their components, that wouldn't be present without them, or they are reshuffling noise from stocks with low ETFs ownership to stocks with a high one?

The argument for the first hypothesis is that these funds are providing trading low-cost and high frequency opportunities which weren't available before and consequently attracting new investors and new strategies. On the other hand, the supposition that ETFs represent only a new, cheaper channel for existing investors to trade the underlying securities is admissible as well. This last argument could be easily applied also to futures and other derivatives; however ETFs give to investors a broader range of market segment specialization.

The only way to test the two hypothesis is by evolution of ETFs ownership and volatility overtime. If the hypothesis of the new layer of demand holds, we should see an increase of the stocks returns volatility as they are included in the ETFs portfolios. The aggregate volatility is, instead, predicted to be steady in case of the reshuffling hypothesis since ETFs shouldn't change it.

The authors regressed the average daily volatility of all stocks included in CRSP, against the lagged average ETFs ownership. To exclude the possibility that the estimates would be influenced by institutional ownership, index and active funds activities are used as independent variables. A trend is then used to capture all the developments in global conditions, reduction in trading costs as an example. The new-layer-of-noise hypothesis is supported by the results: the inclusion of the stocks in ETFs portfolios significantly and positively impacts their volatility.

Despite the evidences are found to be against the second hypothesis, the presence of a shift in returns volatility from some stocks to others as the ownership of ETFs increases, it is not excluded. To investigate on this possibility, stocks are divided in five different quantiles of ETFs ownership (from 0,7% to 4%), for each of them the average monthly volatility is regressed on the average lagged ETFs ownership and controls are included. In Table 6 we see that the volatility of all the 5 groups increases with ETFs ownership, excluding a noise reshuffling among stocks and that the coefficient turns higher with increase in the lagged ownership, strengthening the causal association between stocks prices noise and the inclusion in ETFs portfolios[67].

[67] David, Franzoni and Moussawi, 2015.

Table 6 Regression of Volatility and ETFs Ownership, by Quintiles of ETFs Ownership

Dependent Variable:	Volatility(t+1)				
Quintile of ETFs ownership	**Smallest**	**2**	**3**	**4**	**Largest**
ETFs ownership(t)	0,189***	0,213***	0,206***	0,216***	0,247***
	(3,532)	(4,075)	(3,890)	(4,154)	(3,856)
IF ownership(t)	-0,063	-0,068	-0,049	-0,049	-0,093
	(-1,062)	(-1,144)	(-0,823)	(-0,863)	(-1,381)
AF ownership(t)	0,025	0,060	0,091*	0,089*	0,150**
	(0,497)	(1,193)	(1,799)	(1,823)	(2,560)
Volatility(t)	0,760***	0,688***	0,656***	0,638***	0,667***
	(15,050)	(12,508)	(11,261)	(10,779)	(11,548)
Trend	0,000	0,000	0,001	0,000	0,002
	(-0,027)	(-0,238)	(-0,606)	(-0,183)	(-1,216)
Observations	149	149	149	149	149
Adjusted R^2	0,759	0,691	0,648	0,662	0,726

***, **, * represent statistical significance at the 1%, 5%, or 10% levels, respectively.
Source: David, Franzoni and Moussawi, 2015.

4. COMMONALITY IN THE RETURNS PATTERNS OF ETFS UNDERLYING PORTFOLIOS

So far, thanks to the David, Franzoni and Moussawi's researches, we found empirical evidences that ETFs, through their shares creation and redemption mechanism and the related arbitrage activity, represent a channel for non-fundamental shocks propagation into their underlying securities market. As a consequence, it comes with no surprise that a causal relationship is found to exist between the ETFs ownership of a stock and its returns volatility.

We deepen the subject by wondering if, since ETFs transmit the same shock to all their components, they create commonality in the returns behavior of the assets included in the underlying portfolio.

Wurgler, in his 2011 work, investigates the consequences of index-linked investing and finds evidences that, with the spreading of passive investing, the market has become unable to absorb index-shaped stocks demand.

The inclusion of a stock in the S&P 500 does not depend on its fundamentals or investment potential, rather it is based on the liquidity of the shares and their market representativeness. Every time a new stock is added to the Index, index funds managers tracking the S&P 500 must buy the same percentage, no matter if the stock is overpriced. On average, the value of the securities added

to the Index between 1990 and 2005 has been observed to have increased about 9%, deleted stocks have plunged even more. Intuitively, the basic explanation for this phenomenon relies on the interactions between supply and demand. Even though a part of the increase in the prices could be easily attributed to the expected increase n the stock liquidity, we need to remember that this latter is one of the same reasons why the stock has been included in the Index portfolio; in addition, mostly important, changes in liquidity proxies such as volume bid-ask spreads and quoted depths are observed to be too small to justify such big price appreciations.

It is worth noticing that the same inclusion-effect has been observed for other indexes as well such as the Russell 2000 and 1000, Nikkei 250, MSCI country indices and others[68].

The most relevant evidence Wurgler observes is that, as soon as a new stock is included in the S&P 500, its returns pattern starts to change. The stock begins to behave more similarly to the other securities included in the index portfolio, slowly drifting away from the market remaining part. As a matter of fact, stocks included in the Index between 1978 and 1997 have been experiencing a significant price premium in comparison to other comparable stocks in terms of size and industry, kept out from it[69].

Similarly to the prices jumps and falls, this is mainly related to the highly correlated money outflows and inflows the stocks experience after their inclusion inside the index portfolio. In fact, the net flows observed pouring into index-linked securities are not totally correlated to the other investors' strategies: by definition they are different from the approaches applied by active investors, they are more interested, for example, in the price parity between the Index derivative and its underlying portfolio (i.e. index arbitrageurs) rather than simply tracking the relative index and no-index stocks valuations. Overtime this creates a common trend that causes the index members to move more closely while detaching from the non-members[70]

Given these evidences, we proceed investigating the role that ETFs play in this scenario given that ETF arbitrage has a higher probability to drive returns commovement in the underlying portfolio than other correlated money flows. In fact, taking position on both the ETF and the underlying stocks, arbitrageurs might cause the securities prices to move in the same direction, creating a common exposure different from the assets fundamentals[71].

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[68] Wurgler, 2011.
[69] Morck and Yang, 2001.
[70] Wurgler, 2011.
[71] Da and Shive, 2017.

Da and Shive carry out a thorough analysis regarding the existing link between ETFs ownership and the return commovement among the assets included in their portfolios. In a time frame going from July 2006 to December 2013, they use a sample of 549 US plain equity ETFs and 4.487 stocks, of which 4.318 are held at least by one ETF during the period. The shares belong to firms having a minimum of 100$ million market capitalization and a price per share of 5$ or greater. The ETFs are observed to hold, on average, the 0.113% of their underlying baskets market capitalization, that, if considered together, adds up to a distinctive part of them. It is worth to notice that the average ETFs turnover is 3%, showing much more liquidity than the stocks do, whit a mean of 1% daily. Moreover, the authors compute a variable called *N. Holdings*, that is represented by the stocks in the ETFs portfolios that matches with the ones in the stocks sample and on average counts to 261 stocks.

To conduct this research, different measures are used. First, the authors construct a measure for the average correlation of stocks comprised in an ETF portfolio. This is called *Fratio* (Fund Level Variance Ratio), is computed monthly and consists in the ratio between the variance of the average underlying stocks daily returns and the average of the variances of the underlying stocks daily returns. Then they use three proxies for the ETFs activity at the portfolio level: *Holdings%* as the proportion of the underlying basket held by an ETF, *SD Shares* (the standard deviation of the daily outstanding ETF shares divided by the monthly average outstanding shares) capture the intensity of the ETF creation and redemption activity, providing a linkage to the demand volatility the underlying stocks and *ETF Turnover* that is the monthly average ratio of the fund shares traded and the shares outstanding during a specific day.

They start by regressing the *Fratio* on ETFs activity measures to investigate which is the variable affecting the portfolio stocks correlation the most. Time and funds fixed effects are used to capture the effect of elements such as industry, market return and volatility (columns 1 to 4) in addition to the introduction of an interaction term between the two (columns 5 to 8); this latter is used to address the concerns that stocks might experience an increase in correlation due to their fundamentals, since ETF activity has been increasing over all the sample time period this could create a spurious relationship between the two terms.

Table 7 shows the computed coefficients. We see that SD Shares is always non-significant while Holding% becomes when the interaction variable is introduced.

Table 7 Regression of Fund Level Variance Ratio

Dependent Variable	**Fratio**			
	(1)	(2)	(3)	(4)
Holdings%	0.0381***			0.0417***
	(0.0131)			(0.0135)
SD Shares		0.0212		−0.0204
		(0.0215)		(0.0237)
ETF Turnover			0.145***	0.155***
			(0.0325)	(0.0358)
Expense Ratio	−2.776	−2.777	−2.449	−2.421
	(2.057)	(2.049)	(2.085)	(2.084)
Log(TNA)	−0.00507**	−0.00336	−0.00346	−0.00533**
	(0.00251)	(0.00259)	(0.00254)	(0.00246)
Log(Nholdings)	−0.0559***	−0.0562***	−0.0559***	−0.0555***
	(0.00950)	(0.00947)	(0.00945)	(0.00947)
Time FE	YES	YES	YES	YES
Time FE*Fund	NO	NO	NO	NO
Fund EE	YES	YES	YES	YES
Observations	23,813	23,813	23,813	23,813
R^2	0.748	0.7638	0.765	0.7655
	(5)	(6)	(7)	(8)
Holdings%	0.0116			0.00987
	(0.0160)			(0.0155)
SD Shares		0.0103		0,0261
		(0.0221)		(0.0240)
ETF Turnover			0.140***	0.147***
			(0.0302)	(0.0322)
Expense Ratio	6.274***	6.199***	7.042***	7.134***
	(2.228)	(2.244)	(2.194)	(2.178)
Log(TNA)	−0.00478	-0.00431	-0,00418	-0,00458
	(0.00448)	(0.00436)	(0.00427)	(0.00440)
Log(Nholdings)	−0.0591***	-0.0591***	-0.0589***	-0.0589***
	(0.00852)	(0.00852)	(0.00848)	(0.00848)
Time FE	YES	YES	YES	YES
Time FE*Fund	YES	YES	YES	YES
Fund EE	YES	YES	YES	YES
Observations	23,813	23,811	23,813	23,813
R^2	0.7863	0.7863	0.7864	0.7865

***, **, * represent statistical significance at the 1%, 5%, or 10% levels, respectively.
Source: Da and Shive, 2017.

Rationally, it's not surprising that ETFs shares creation (and redemption) is observed to be less significant from the moment that it doesn't requires the trading of the basket. ETFs turnover, as

proxy of ETFs arbitrage activity, emerges then as the driver of correlation among stocks returns since it remains statistically significant even after controlling for the two other ETFs activity proxies. Moreover, the turnover coefficient is not expected to be constant among different ETFs or at least it should have a greater effect for larger funds who owns a larger part of the total market capitalization of their underlings. To test this hypothesis the two authors, introduce a combined variable between ETF turnover and Holdings% that is found to be significant.

It's important to notice that ETFs turnover results related with increasing stocks returns correlation because it is itself correlated with turnover at the stocks level throughout arbitrage activity both directly (turnover as main consequence of arbitrage) and indirectly (greater ETFs trading causes discrepancies between their market value and NAV and this triggers arbitrage activity). To investigate on this relationship, daily ETFs turnover has been regressed on the daily average stock turnover to compute the R^2; since the R^2 shows how much variance in the stocks turnover is explained by the ETFs turnover i.e. they follow simultaneous trends, if the hypothesis holds, we expect the ETFs with a higher R^2 to show greater relation between ETFs turnover and stocks return correlation since the former is more likely to drive arbitrage activity. As we see in Table 8, that reports the results obtained by regressing the analyzed ETFs fratios on the same variables as before, dividing the result by R^2 terciles, this is confirmed: ETFs with higher R^2, actually show a higher coefficient.

Table 8 Regression of Fund Level Variance Ratio by R^2

Dependent Variable	**Fratio**		
	R^2 Low	**R^2 Medium**	**R^2 High**
Holdings %	0.0252	0.0248	0.0477**
	(0.0189)	(0.0158)	(0.0187)
SD Shares	0.0222	0.00728	0.0585*
	(0.0373)	(0.0261)	(0.0342)
ETF Turnover	0.0968*	0.0631**	0.184***
	(0.0502)	(0.0282)	(0.0377)

***, **, * represent statistical significance at the 1%, 5%, or 10% levels, respectively.
Source: Da and Shive, 2017.

Finally, arbitrage can only be successful when the underlying stock can be easily and not expensively traded. For this reason, ETFs holding bonds, asset or mortgage-backed securities or other financial

instruments hard to be traded quickly, should not see increase returns correlations in their basket securities.

121 ETFs having such financial instruments in their baskets have been selected and the same regression has been applied to them and as we were expecting their turnover coefficient is no more statistically significant as it shown in the second column of Table 9. A full sample and one comprising mostly stocks are presented as well.

Table 9 Regression of Fund Level Variance Ratio by Basket Securities

Dependent Variable	Fratio		
	Full Sample	**Bond > 0**	**Common ≥ Median = 99,67%**
Holdings %	0.0417***	0.0780	0.0168
	(0.0135)	(0.102)	(0.0194)
SD Shares	−0.0204	−0.244*	−0.0135
	(0.0237)	(0.125)	(0.0258)
ETF Turnover	0.155***	-0.0705	0.174***
	(0.0358)	(0.300)	(0.0456)
Expense Ratio	−2.421	113.0	−0.714
	(2.084)	(74.10)	(2.595)
Log(TNA)	−0.00533**	−0.00707	−0.00409
	(0.00246)	(0.0151)	(0.00273)
Log(Nholdings)	−0.0555***	−0.0206	−0.0566***
	(0.00947)	(0.0268)	(0.01000)
Time FE	YES	YES	YES
Fund FE	YES	YES	YES
Observations	23,813	1,230	12,613
R^2	0.7655	0.7199	0.7554
Avg abs(gap)	0.0022	0.0054	0.0019

***, **, * represent statistical significance at the 1%, 5%, or 10% levels, respectively.

Source: Da and Shive, 2017.

It is worth noticing that for all the ETFs having their baskets made by more than the 99,67% of stocks, their arbitrage activity has a greater influence on their stocks returns correlation. The last row reports the average discrepancy between the NAV and the market value of the ETFs during the period. As a consequence of the limits-to-arbitrage, the gap is higher for the fixed income-

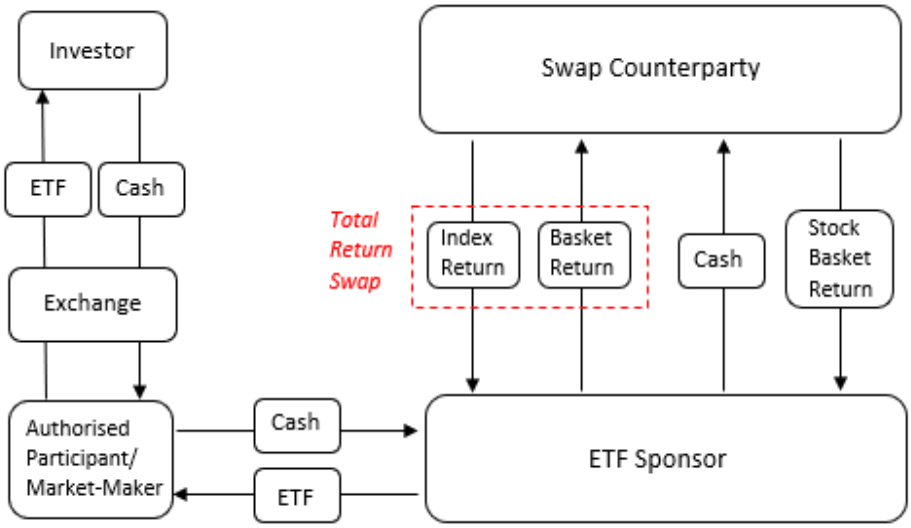
bearing ETFs, this might suggest that higher discrepancies rather than showing arbitrage opportunities, they show arbitrage difficulties[72].

5. FROM PHYSICAL TO SYNTHETIC ETFS

So far, we have mainly analyzed the effect ETFs activity has on the underlying baskets of securities. We found evidence that the arbitrage activity APs and common investors carry out both on the ETF and stock market levels, in order to keep ETFs market value and NAV aligned, has potential to cause noise on the underlying stocks propagating non-fundamental shocks and, at the same time causing pattern of commovement in their returns. The effect is even more accentuated when large ETFs are involved, and the stocks are more liquid.

In the first chapter, we explained how ETFs can be differentiated by the replication method they use to track the underlying portfolio behavior. Physical ETFs hold the securities they are trying to mimic in their portfolio, the APs usually give (or receive) the underlying asset in exchange of the fund shares. Fund manager though, can also decide to replicate the behavior of a certain index, stock or similar without physically owning the securities. Synthetic ETFs usually takes derivatives positions like a total return swap agreement with a financial institution that has the contractual duty of delivering the return on the benchmark to the ETF[73].

Figure 3 Unfunded Swap ETF Structure.



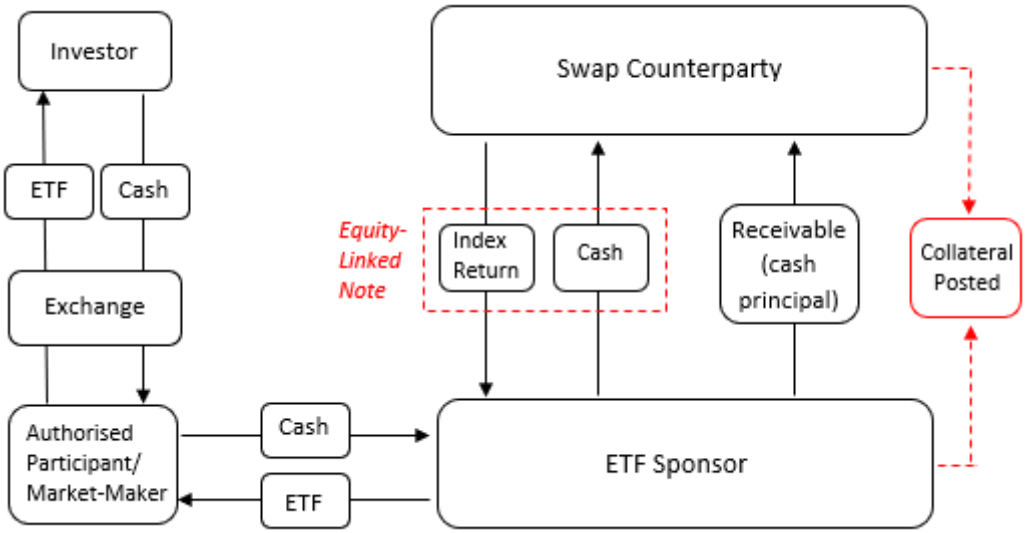
Source: Ramaswamy, 2011

[72] Da and Shive, 2017.
[73] Malamud, 2015.

Alternatively, in Figure 4 the funded swap structure is pictured. The ETF sponsor delivers cash to the swap counterparty, which won't receive further cashflows, and the received collateral basket is kept in a segregated account created with an external custodian on which the fund has legal claims. Since the ETF is not the beneficial owner of it, the sale of the basket securities in case of swap counterparty default can be affected by delays[74].

While physical ETFs investors are exposed to a tracking error risk, synthetic ETFs are subject to a different one. In this latter replication scheme, it's the swap counterparty assuming the risk of any deviation of the ETF return from its benchmark and, as a consequence, investors in the ETF bear the risk of the counterparty default[75].

Figure 4 Funded Swap ETF Structure



Source: Ramaswamy, 2011.

When selling synthetic ETFs shares, usually ETF sponsors try to highlight the lower tracking error without excessively focusing on the counterparty risk. Moreover, they emphasize the greater cheapness with respect to the ones employing physical owning the security. The spreading of ETFs popularity among investors and the recent decline in the investment funds expense ratios is causing

[74] Ramaswamy, 2011.
[75] David, Franzoni and Moussawi, 2017.

the competition in the sector to rise, pushing ETFs managers to employ different replication methods in order to optimize the fund fee structure.

Indeed, one of the reasons for the choice of using a synthetic replication schemes is cost efficiency. Physical replication might be optimal when dealing with indices focused on a specific market sector and/or region which present a good level of liquidity and are widely traded. On the other hand, this might become expensive for broader segments like emerging market or fixed income indexes since their underlings might be harder to trade, less liquid and costlier. In those circumstances, synthetic replication becomes a cost-efficient tracking method[76].

An additional reason to use these replication methods is that they allow to exploit possible synergies between the ETF sponsor and its swap counterparty, i.e. the investment banking division of the parent bank and its asset management department. Investment banking activities require the bank to set aside a large amount of stocks and bonds for mark-to-market purposes and they need to be funded; when they are particularly illiquid though, the bank has no choice but funding them either in the unsecured or repo market, with high haircuts. If the bank is able to transfer these securities as collateral to its sponsored ETFs, the investment banking division might benefit from a reduction in warehousing costs and part of this advantage can be transferred to the ETF investors as well, through lower total expense ratios.

Unfortunately, there might be incentives to give as collateral illiquid assets since, as we said, the bank can efficiently fund them with no extra costs and, if when the unfunded scheme is employed, it may benefit also from lower regulatory capital requirement. Regulations over liquidity standards like the ones introduced by Basel III might further push banks to use these practices. As an example, the new requirements on the Liquidity Coverage Ratio introduced in 2015 requires banks to hold highly liquid assets counting for 100% (as cash, treasuries and corporate bonds) of their net cash outflows over a 30-days stress period and unsecured and secured funding backed by either illiquid or low credit rating assets maturing over this period are comprised. If the financial institution decides instead to use them as collateral in a swap ETF contract, which typically will have a duration greater than one year, they will need a coverage only about the 20%.

The increasing use of synthetic replication schemes in ETFs and the greater complexity of these products might create risks for financial stability. First of all, we need to remember the main risk exposure difference between synthetic and physical replication. In fact, as we said, the former

[76] Ramaswamy, 2011.

transfer the tracking error to the swap counterparty, who has to deliver the total return of the benchmark to the ETF. Nowadays there exists low transparency on the methods used by the financial institution to deliver the contractual cashflow to the fund but they usually create an optimized representative subset of the securities included in the tracked index i.e. physical replication. This means that the bank entering in this this financial contract is not only exposed to the general trading book risk but to the tracking risk as well, potentially undermining its financial stability if not well managed. Since ETFs cannot restrict investors redemptions when markets are low in liquidity, we also need to consider the potential issues that the institution would incur in providing the liquidity needed when large ETFs withdrawals happen suddenly, meanwhile keeping the tracking risk under control[77].

While the tracking error is transferred to the bank, the ETF sponsor is still exposed to the counterparty risk. In period of crisis or general counterparty risk spreading, large institutional investors might be encouraged to withdraw their investments from synthetically replicated ETFs. This happens because the collateral basket used by banks usually heavily diverge from the one composing the ETF benchmark and, as we explained before, swap counterparty might have incentives to include illiquid assets in it. Moreover, institutional investors have been observed to be the first market participants to exit when crisis happen, possibly triggering general panic when fund solvency is doubtful and raising correlation among securities: while banks might be forced to sell assets included in the collateral basket, APs might start asking for ETFs shares redemption in order to provide liquidity to the market, setting a loop further undermining the counterparty solvency.

Funding risk might come along with large investors withdrawals and increasing default risk: swap ETF arrangements are considered by banks cheap ways to access funds from the moment that final investors are not provided with the liquidity they have been promised. When redemptions take place, cash is needed to be given back to the investors in exchange for the collateral basket that might be not as easily marketable as expected. Since market makers could be prone to give more relevance to these funding activities rather than accomplished their responsibilities to maintain liquidity and fairness in the financial markets aggregate risk might be enhanced by a collapse in financial intermediaries access to funds and consequent reinforcement of financial system funding stress.

[77] Ramaswamy, 2011.

Finally, the common perception of ETFs market as liquid can lead investors to underestimate the market risk deriving from the increasing complexity of these products and the creation of options and leveraged instruments on them. In fact, when employing synthetic replication methods, products transparency decreases since different players and markets start to get involved and risk monitoring ability decreases, leaving the final investors with low clarity on the replication mechanics of the ETF bought[78].

6. SYSTEMIC RISK ENHANCEMENT

Different episodes in the past years have triggered regulators attention towards ETFs and the risk they may represent in periods of market stress. The main concern is that these financial products may be a channel for liquidity shocks spreading among their underlying securities.

Investors are interested in ETFs for all the low-cost diversification opportunities that they offer. In particular in the last years, where interest rates have been through a low-phase, these funds have not only been used for investing in the classic liquid equity market, but also to gain exposure to less traded securities like fixed-income securities, municipal bonds and emerging markets products.

As we have seen in the precedent paragraphs, ETFs might have a mixed effect on market liquidity, hanging from price discovery conduits for their components by providing a market price for them in times of poor liquidity, to serve as accelerators for volatility spreading throughout the market during periods of market instability. When securities prices information is not reliable, or arbitrage is found out to be too costly, market makers and arbitrageurs are likely to exit the market ceasing the intermediation activity and causing more illiquidity in their underlying portfolios markets, shocks amplification and spreading.

This is demonstrated by several episodes in the recent history, where arbitrageurs didn't find incentives to enter the market during stressed periods and this consequently led to big mispricing between ETFs and their NAV.

During the Flash Crash happened in May 2010 for example, the S&P 500 sank roughly the 9% in 20 minutes, probably caused by the spreading of the unusual volatility that was before detected in the S&P 500 future contracts. On that day, the anticipation of news about the Greek debt crisis prompted institutions to sell the ETFs shares they were owning; at the same time, ETFs

[78] Ramaswamy, 2011.

arbitrageurs stepped in with the aim of buying the ETFs shares and selling the underlings. Unfortunately though, liquidity shortages in some exchanges caused the prices data to be not reliable enough, leading arbitrageurs to exit the market and boosting the exacerbation of the market turbulence. During those 20 minutes, ETFs market liquidity dried up and price discovery ceased to occur, causing large discrepancies between ETFs market price and the prices of their components[79].

Volatility can affect the ability to trade ETFs as well. For example in June 2013, the Federal Reserve Chairman raised fears about the approaching of the end of Quantitative Easing causing a general and heavy sell-off. Here, one ETF decided to allow only in-kind redemption, since the transaction fees applied to cash transactions i.e. cash redemptions, were so high to exceed the expense limit it had for that day; moreover, other APs couldn't keep transmitting redemption orders since they had reached internal net capital limits. These events caused a break on the arbitrageurs' activity and ETFs prices to fall under investor selling pressures[80].

After the Flash Crash of 2010, the SEC decided to introduce an inhibition to trade on single securities, ETFs included, when they are facing period of extreme prices swings. On the 24th of August 2015, this ruling caused the shares of more than 300 ETFs to stop trading: market makers and APs exited the ETFs market after a trading halt on futures that faced steep declines before the market opening and that these market participants were used to employ as hedging instruments during volatile markets sessions. On that day, the trading volume of ETFs was representing the 42% of the total US Equity Market and the shock hitting their prices was eventually spread to their underlings without any fundamental reason[81].

Different studies analyzed in this chapter have shown evidences that movements in the ETFs market price do influence the value of their portfolio components. The arbitrage activity performed by investors to exploit the price differences between ETFs market value and their portfolios components prices doesn't always serves as price discovery instruments. We saw how market shocks in the former can be easily propagated to the latter through arbitrage activity, even when fundamentals are not involved, eventually reversing on the second next trading day but still increasing prices movements and so market volatility. This non-fundamental shock propagation is further enhanced by the commovement between ETFs underlying assets. Indeed, Da and Shive

[79] David, Franzoni and Moussawi, 2017.
[80] Office of Financial Research, 2013.
[81] David, Franzoni and Moussawi, 2017.

research showed that the prices of securities held by ETFs tend to display commonality in their returns over time.

Due to the increasing use of exotic ETFs and synthetic replication methods, when talking about ETFs, counterparty and solvency risk need to be considered, together with the level of transparency of the financial product delivered to the final investor.

III. EVIDENCES FROM FLASH CRASHES

As we anticipated before, the 6th of May 2010 equity-based securities in United States have been hit by a fast and steep decline in prices that took their quotation to lose from 5% to 10% of their values in approximately 20 minutes and eventually reversed by the end of the trading day. The Securities and Exchange Commission estimated that among approximately 300 financial instruments, roughly 20.000 trades got carried out with prices differing more than 60% from their values some minutes before.

Among all the affected instruments, ETFs have been identified as the one category whose prices dropped the most. According to the "clearly erroneous execution rules", the SEC can cancel trades that, under its examination, have been submitted by fault. From 14:40 and 15:00, out of 326 broken trades, 70% of them were composed by ETFs. As we can see by Table 10, which shows the trades involving ETFs in that time interval, approximately 96% of ETFs shares exchanged experienced a loss between 0 and 10% with respect to their quotation at 14:40. 3 million of them though, showed losses accounting for the 90-100% of the initial values. 160 ETFs lost almost their total value with respect to their closing price on May 5th, considering the lowest transaction price executed on May 6th[82].

Table 10 ETFs Trade Executed at a Loss

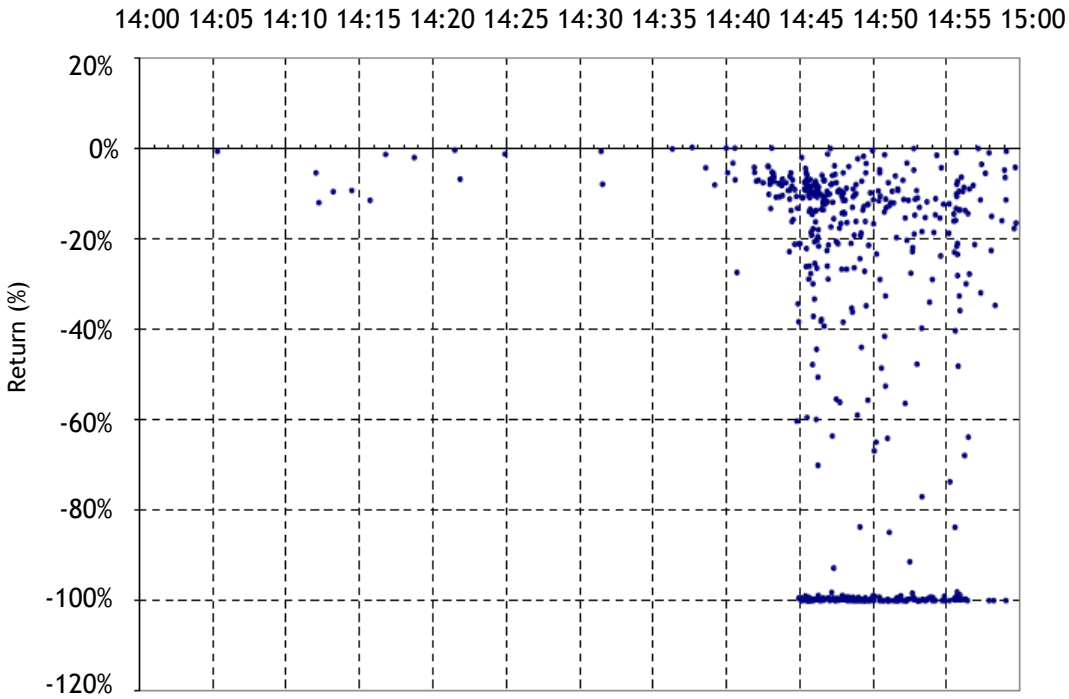
	Total Trades	**Total Volume**	**Total Volume ($)**
All Trades	1.265.637	456.335.890	22.381.572.444
Losses	794.607	279.836.213	14.135.649.267
0% to -10%	761.866	269.307.656	13.909.304.917
-10% to -20%	13.607	3.988.959	145.247.171
-20% to -30%	3.714	1.144.431	40.234.001
-30% to -40%	2.041	753.856	18.934.582
-40% to -50%	1.151	320.661	6.612.612
-50% to -60%	1.148	344.774	7.657.548
-60% to -70%	758	314.03	4.111.592
-70% to -80%	505	233.617	2.021.741
-80% to -90%	775	176.632	1.025.499
-90% to -100%	9.042	3.251.597	499.604

Source: SEC and CFTC, 2010 (B).

[82] SEC and CFTC, 2010 (B).

Looking at Graph 12, we see the timing of the daily lows of these instruments. In contrast with all the other securities, which daily lows were experienced more heavenly during the one-hour timeframe, the highest frequency for ETFs is reached from 14:45 and on: the blue line is composed by all the ETFs losing their total value at their daily lowest price[83].

Graph 12 Timing of ETF Daily Lows from 2 to 3*



*Daily Lows are computed with respect to the May 5th closing prices.
Source: SEC and CFTC, 2010 (B).

1. THE TRADING DAY

The trading day in U.S. markets started more volatile than usual due to some unanticipated political and economic news concerning European sovereign debts and Greece potential default. To hedge against this scenario, to be willing to take more risk, investors started to ask for higher premiums on a different number of securities e.g. credit default swaps on different sovereign debt securities in Europe[84].

[83] SEC and CFTC, 2010 (B).
[84] SEC and CFTC, 2010 (A).

Financial markets started to experience a "flight to quality" meaning that investors began to sell what they were feeling to be riskier investments in order to purchase safer securities like gold and U.S Treasuries: gold futures quotation rose about 2,5% and the 10-years U.S. Treasuries yields plunged 5%. At the same time, the VIX saw his fourth highest spike of about 31,7%.

The overall turbulence started to spread to equities prices as well, triggering a number of Liquidity Replenishment Points (LRPs)[85] on quoted NYSE single stocks above average.

Derivatives instruments on the S&P 500 were affected as well. In particular, the liquidity on the most actively traded products based on the index, namely the futures contracts on the S&P 500, the "E-Mini", and the SPY, experienced a draining on their buy-side liquidity plummeting 55%, from $6 to $2,65 billion, for the former, and 20% for the latter, from $275 to $220 million.

Around 14:32, a large institutional investor input a selling order in the market to sell 75.000 June 2010 E-Mini contracts in order to hedge against the drop in equities prices. The automated execution algorithm set to sell them was arranged with no instructions regarding neither the price nor the time but only to respect an execution rate of 9% the trading volume observed the minute before.

The order was executed extremely rapidly in about 20 minutes, a very short time considering that such big trades are usually carried out in one whole trading day. At first, the orders were absorbed by high frequency traders, fundamental buyers and cross-market arbitrageurs and the trading volume increased, so the automated trading program sped up placing orders even though the previously sent hadn't yet been executed.

In about 3 minutes, from 14:41 to 14:44 the price of the E-Mini sank of 3% meanwhile arbitrageurs who initially bought the futures contracts started to sell an equivalent quantity on the equity markets in order to profit. Consequently, the selling pressure was spread to the SPY that in turn lost 3% of its initial value[86].

The volumes started to move faster so that in 15 seconds 27.000 E-Mini contracts (49% of the total volume traded) were exchanged by HFTs that started to sell and re-buy the securities between each other, due to the lack of buyers. The liquidity depth of the demand for the future contracts

[85] LRPs are defined as volatility breaks. They are triggered when the price of a trade on a security hits predetermined lower or higher threshold with respect to the trading price. On this occasion, the Exchange will pause in order to make more liquidity to flow in the market.
[86] SEC and CFTC, 2010 (A).

decreased to less than 1% of its morning level and the prices additionally sank of 1,7% in the same time-period. The SPY plummeted of 6% from 14:41 to 14:45 and the net liquidity imbalance on the futures contract was computed to 30.000 contracts for the selling side.

Finally, to avoid further dips in the prices, the Chicago Mercantile Exchange stopped the trading on the E-Mini for 5 seconds at 14:45:28. The selling pressure started to relax while the buyers slowly re-entered the market so that when the trading started again, both the E-Mini and the SPY began to recover.

At the same time, the liquidity shock was spread to equities. Due to the steep drop in prices, many automated trading systems of different actors in the market stopped in order to let the participants to evaluate the convenience of staying in the market. As a result of their risk analysis, many market makers decided either to exit, to decrease the liquidity made available or to increase their bid-ask spreads.

The buying interest on individual stocks and ETFs started to decline despite the recover in the SPY and E-Mini, so that the selling pressure drag the prices further down. In twenty minutes, from 2:40 to 3:00, $56 billion were traded accounting for almost 2 billion of shares and the 98% of them with quotes within 10% down of their price before the decline.

For some individual securities (including ETFs), liquidity completely disappeared and orders to either buy or sell at the market, finding no counterparty, were executed at absurd prices resulting from stub-quotes. Indeed, stub-quotes are prices set by market makers to be far away from the current quotes and they are not intended to be executed; liquidity providers issue these quotes in order to respect their duty of providing continuous quotations for both sides, even though they exited the market.

As a result, the execution of trades at these unrealistic prices triggered different LRPs from the stock exchange, resulting in a notable number of broken trades[87].

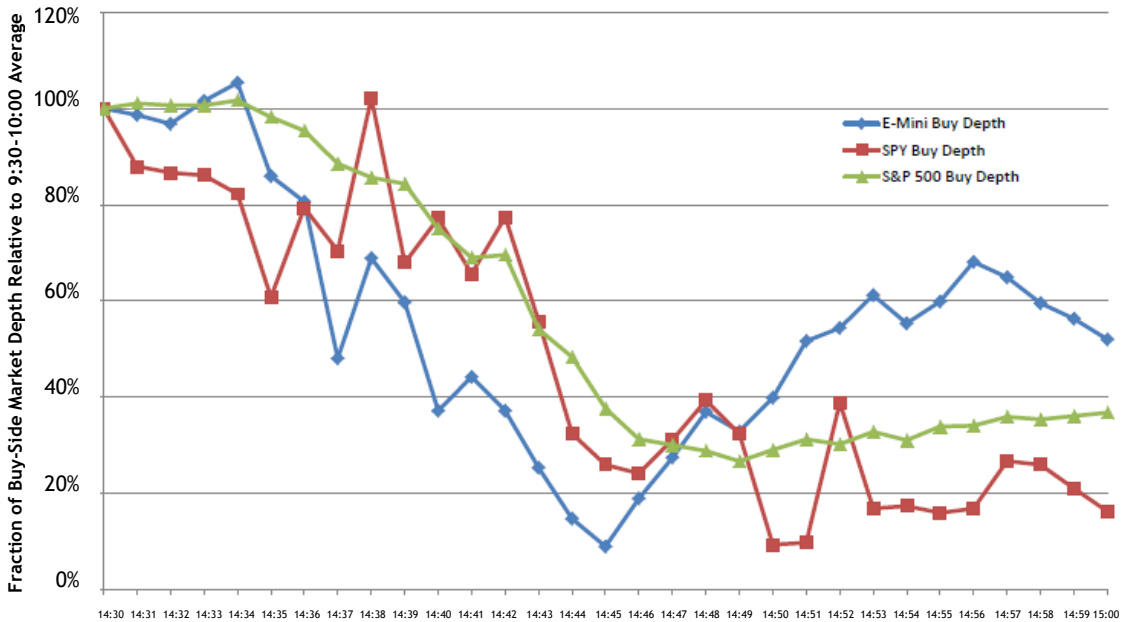
Eventually, at 15:00, both buyers and sellers came back in the play and price discovery started to work again, reverting the quotations to normal levels. In that 20 minutes time-range, investors bought and sold over 300 securities in 20.000 trades. As we will see, it's important to highlight that often volumes must not be confused as a synonym for liquidity[88].

[87] SEC and CFTC, 2010 (A).
[88] Borkovec et al, 2010.

It's worth noticing that, looking at the behavior of the buy and sell depth from 14:30 to 15:00 respectively on the E-Mini, the SPY and the S&P 500, we identify different trends. In fact, while the first two experienced a full-depth liquidity drawdown focused on the buyside, the S&P 500 buy and sell orders maintained a certain balance even during the prices drawdown. Moreover, in Graph 13 we can see that the buy-side liquidity shortage firstly hit the E-Mini, followed by the SPY and only afterwards spread to the S&P500; in the same way, the recover started first in the futures contracts.

In other words, the prices fall hasn't been triggered by any fundamental liquidity shock on the S&P 500[89].

Graph 13 E-Mini, SPY, and S&P 500 Buy-Side Market Depth



Source: SEC and CFTC, 2010 (A).

2. THE ETFS BEHAVIOR

As we noted at the beginning of this chapter, ETFs have been one of the categories that has been hit the most by the 2010 Flash Crash. In its report on the event, the SEC identified market makers withdrawal as one of the main causes of the liquidity shortage.

[89] SEC and CFTC, 2010 (A).

ETFs market makers can use these funds with different purposes: some of them are interested only on immediate trading considering these instruments as common stocks, without minding about the prices of the ETFs assets portfolios, others employ ETFs pricing models and depend on the ETF correct underlings values tracking and finally, some market makers use strategies involving trading both on the funds and their components.

When periods of high volatility affect the underlying stocks of the ETFs, the behavior of the market makers adopting the last two strategies are the most hit. In fact, when either uncertainty about prices and data integrity arise or high volatility in their underlying assets causes difficulties in valuing the true ETF value, they are easily prompted to stop providing liquidity by pausing their trading activity, widening the spread or even using stub quotes.

As an evidence, the majority of market makers questioned by SEC, testified that they stop providing liquidity to the ETFs market starting at 2:45 and this has been one of the most probable causes why equity-based ETFs have been one of the categories hit the hardest. Notably, the funds relying on different assets, but U.S. equity securities, haven't been affected so heavily[90].

Moreover, during the crash, the ETFs affected by huge price drops showed discrepancies between their fundamental value and their price. Borkovec, Domowitz, Serbin and Yegerman investigate on the factors that lead to the price discovery failure, referred as the correct ETFs price replication of their portfolios values. They mainly focus on the characteristics of the liquidity provision during the 2010 Flash Crash, considering it as the main responsible for the disproportionate decline in ETFs prices.

The analysis is focused on a sample of 116 usually liquid ETFs and on the time-frame going from 14:40 to 15:00 on May 6, coinciding with the steepest prices decline of the day.

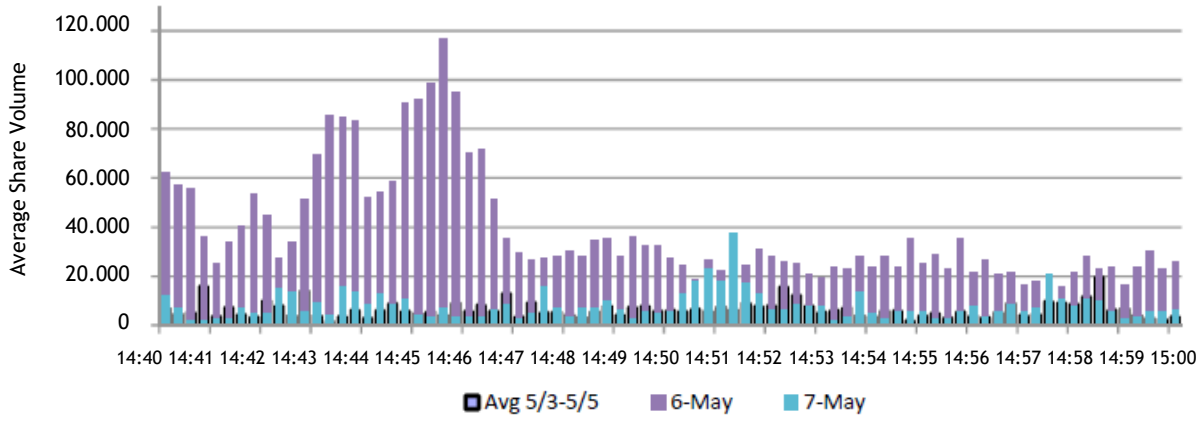
As we previously anticipated and it is shown in Graph 14, the peak of the ETFs traded volume is reached at 14:45, increased about 89% with respect to the one observed at 14:40. Then it sharply declines to a -70% in comparison to its initial volume[91].

Not surprisingly, as the volume increased, volatility in the ETFs prices exploded as well. Lagging the traded volume spike, it increases approximately 231% compared to the 14:40 level, with the

[90] SEC and CFTC, 2010 (A).
[91] Borkovec et al, 2010.

highest points being at 14:47 and 14:49. The authors measured it using the 15 seconds mid-quote pricing.

Graph 14 ETF Share Volume from 2:40 to 3:00



Source: Borkovec et al, 2010.

Usually, the most common proxies used for measuring the liquidity of markets are the bid-ask spreads and time-weighted average spreads. However, the authors decided to use the depth of bid and ask at a certain price in order to measure its development during the crash. They believe the high volatility in this time-frame doesn't make the spreads a reliable measure.

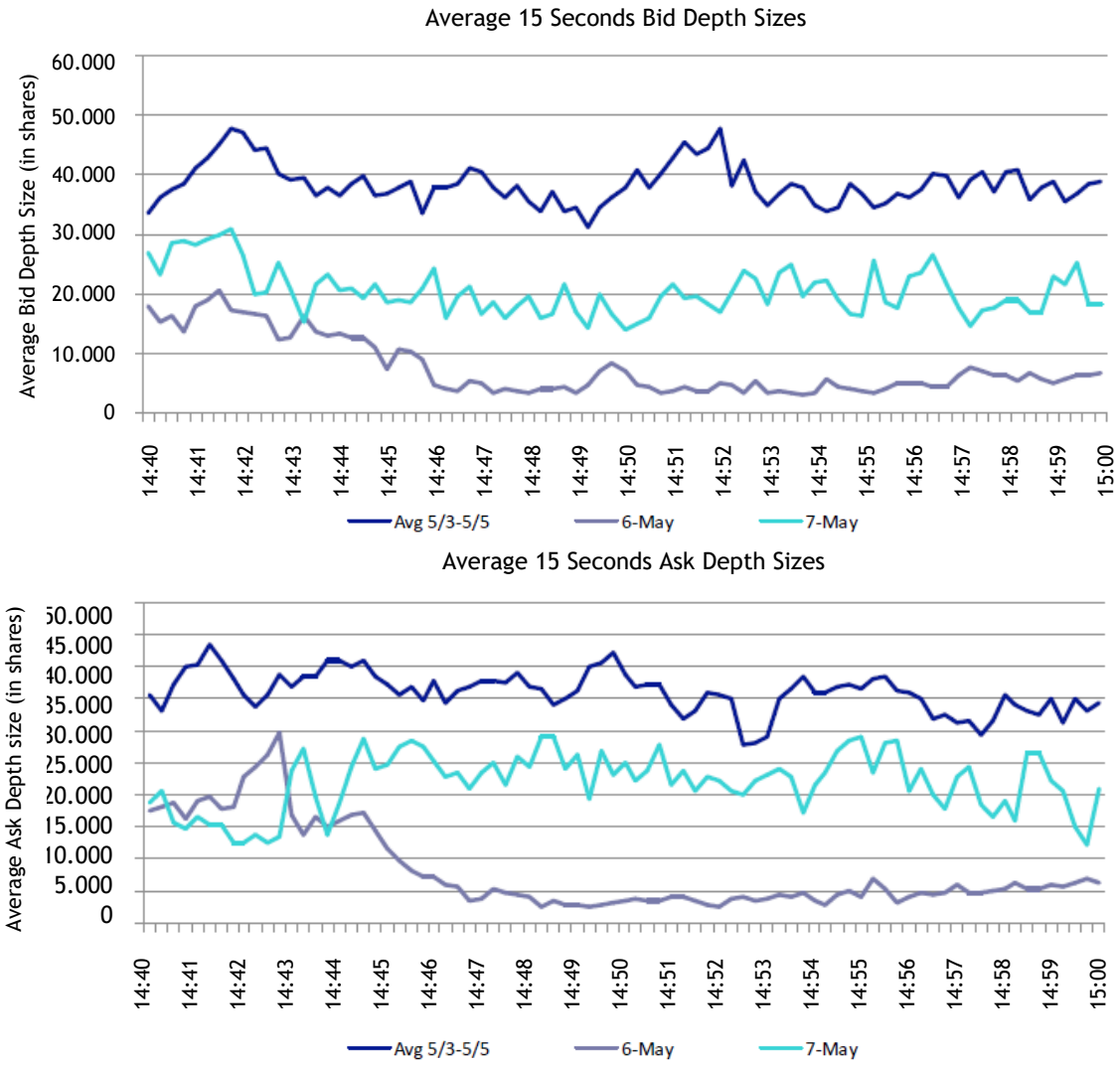
Indeed, analyzing the bid-ask spreads they noticed that it gives a misleading picture of the markets available liquidity since it signals a departure of investors, most probably market makers only from 14:45 to 15:00.

On the other hand, in the Graph 15 the depth for the best bid and best ask price are reported. Two things emerge: first, they show that the liquidity on the 6 May was already lower in comparison with the previous and next days and second, that the market liquidity decline actually started before the one indicated by the spreads. At 14:40 the demand and the offer already were down respectively about 46% and 50% with respect to the previous days. An enhancement in the decline is experienced in correspondence with the volatility increase[92].

[92] Borkovec et al, 2010.

As we said before, the increase in the traded volume is not a synonym of liquidity, in fact they appear to be inversely correlated in this case: as liquidity starts to fall, volume is increasing at a steady pace starting then to fall only after 14:47, when bid and ask depth stabilizes[93].

Graph 15 ETFs Best Price Bid and Ask Depth



Source: Borkovec et al, 2010.

The authors continue their analysis focusing on 24 ETFs included in the 160 identified by the SEC as the ones experiencing the biggest price drop and for which they succeeded in replicating the underlying portfolios.

[93] Borkovec et al, 2010.

The price discovery failure can be easily showed using a correlation analysis. As it is expected to be, the correlation between these ETFs and their underlying portfolios results to be close to one prior to the Flash Crash; on the other hand, in the time frame taken into account, the returns of the funds and their components start to diverge: the correlation drops to 0,4 for most of them, even turning negative for the remaining part.

The main question now is how much the disappearance of liquidity provision contributed to the deviation of the ETFs price from their fundamental value.

Graph 16 reports the IVW (iShares S&P 500 Growth Index) and its underlying portfolio level of first 10 demand and offer prices liquidity in comparison with their returns. As we already said, while the underlying assets liquidity, despite shrinking, it still keeps a certain balance between offer and demand, ETFs shares buy-side totally drains, even in comparison with a declining offer.

The price discovery failure starts to widen as the liquidity shortages enhance and a correlation between the two needs to be recognize: the two negative spikes in the ETFs return come together with the draining of both buy and ask-side.

The same experiment is carried out using the SPY. Even though the ETF is affected by a more moderate decline in prices, the failure of the price discovery mechanism is observed again, concurrently with a drawdown in the available liquidity in both the fund and its portfolio. Graph 17 shows the behavior.

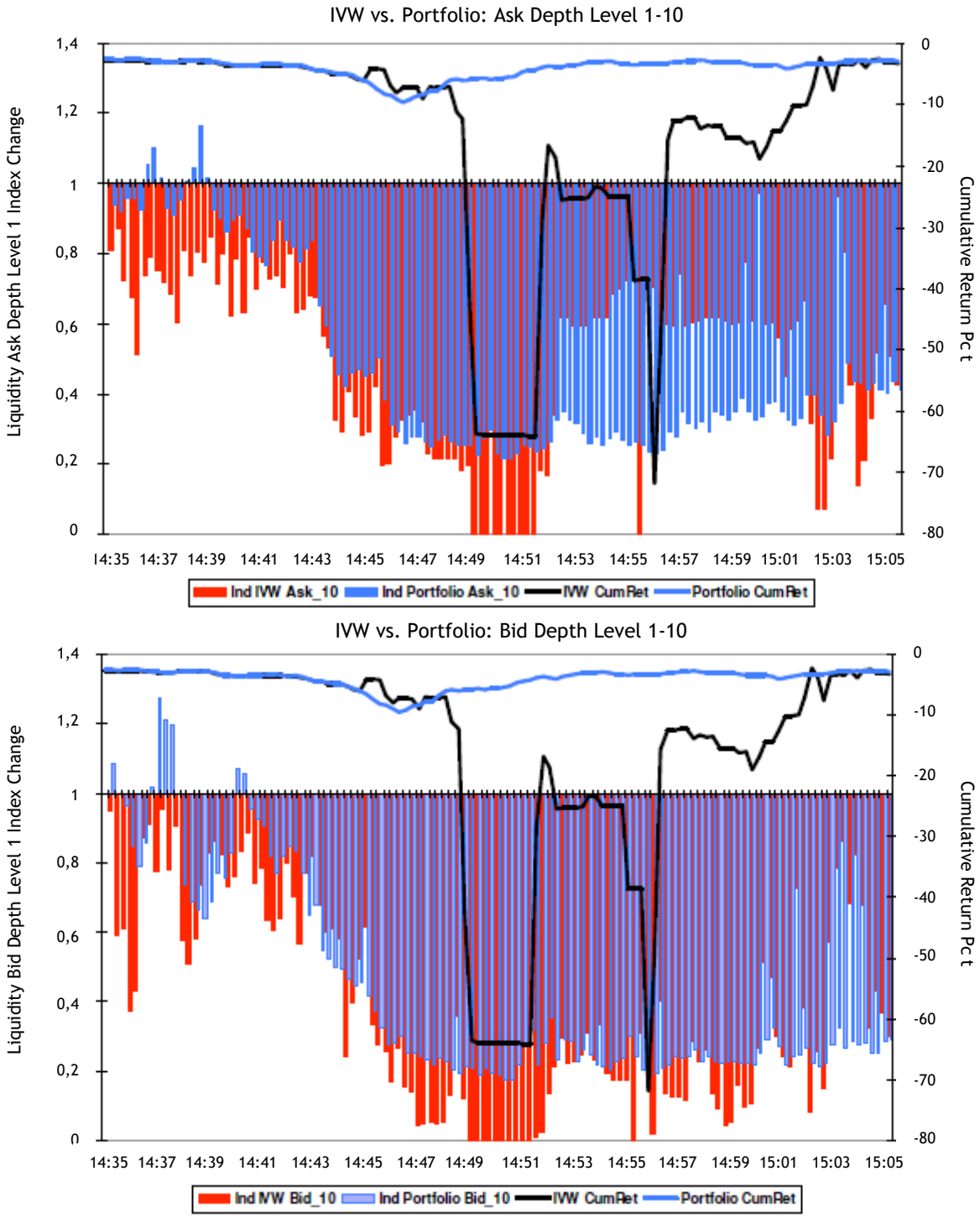
For both the ETFs the mispricing keeps existing until 15:00 and beyond i.e. until the re-stabilization of liquidity provision.

On average, the same trend is observed for all the analyzed ETFs. While the price discrepancy with their underlings becomes bigger as liquidity flies away, it starts narrowing in parallel with the recovery of the bid and ask book depth.

It is worth noticing that, the price discrepancy of the SPY with its underlying portfolio is more moderate in comparison to the other observed ETFs. This fund is also one of the most liquid traded assets and a relationship between these two facts seems to exist[94].

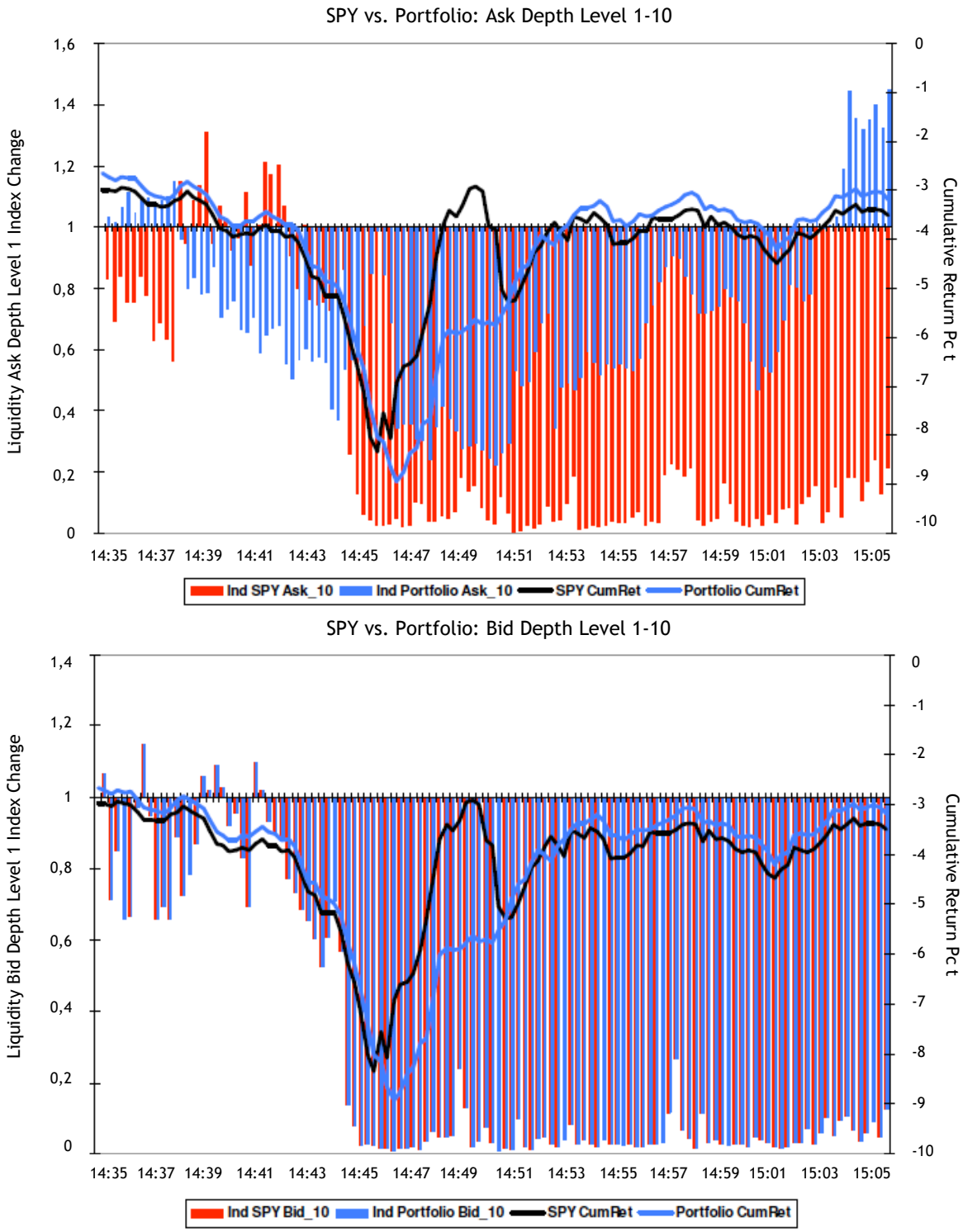
[94] Borkovec et al, 2010.

Graph 16 Cumulative Returns and Liquidity at the 10 Bid and Offer Price Points for IVW



Source: Borkovec et al, 2010.

Graph 17 Cumulative Returns and Liquidity at the 10 Bid and Offer Price Points for SPY



Source: Borkovec et al, 2010.

ETFs have been one the most affected categories during the Flash Crash as reported by the SEC, who believes one of the main reasons for this disproportionate price volatility has been the draining of liquidity as market makers decided to exit the market.

Together with their prices steep decline, the funds values started to deviate from their fundamental price assuming different behaviors than their underlying portfolios. In those 20 minutes crash, their price discovery mechanisms failed to take place and evidences about the existing relationship between lack of liquidity and ETFs price discrepancies have been reported.

3. THE 2010 ENTAIL

After the 2010 Flash Crash, authorities decided to introduce some changes to the exchanges regulations since the measures in place at that time proved not to be sufficient to prevent steep prices declines. New guidelines for breaking "clearly erroneous trades" have been settled and single-stocks trading halts introduced when securities prices are observed to be lower or higher than the 10% of the previous 5-minutes trades prices. Furthermore, in 2013 the Limit Up Limit Down (LULD) provision was implemented at the initiative of FINRA and the U.S. Exchanges in order to give investors the possibility to revert sharp price movements before the trading activity is stopped.

The aim of this system is to avoid the execution of trades above or below a certain range, computed based on a security prevailing price, trading volume and time during the day. When a too high bid price or a too low ask price are submitted in the trading book orders, the instrument in question enters in a "Limit State" lasting 15 seconds. In this time frame, where the security trading keeps going on, market participants have the possibility of reverting the price swing making the asset exit this phase; if this does not happen though, trading activity is halted for 5 minutes. After the pause, the exchange starts a re-opening auction where a new security price and bands are determined in order to allow the trading to start again[95].

Unfortunately, these reforms demonstrated to be still not enough to avoid flash crisis and the propagation of noise throughout the markets. In fact, the Flash Crash of August 24, 2015 was the first time where markets had the possibility of testing these changes that seemed to fit during

[95] Jane Street Group, 2017.

standard trading activity. One of the main problems connected with the LULD trading halts was in fact that they have been conceived for single-stock events and not for broad-market crisis.

The shock was mainly focused on the U.S. equities listed on the NYSE and related products, seeing the S&P 500 sinking 5% and similarly to 2010, ETFs experiencing detachment from their underlying portfolios.

We will now continue our analysis questioning why the new regulations weren't sufficient to stop this sharp decline and if common trends, between the two flash crashes, can be detected in ETFs trading activity and related arbitrage mechanism.

On that day, investors were already filled with bearish sentiment from the previous week strong selling pressures. Moreover, the Chinese Shangai Composite Index, which starts trading before the U.S. market opening, was experiencing an 8,5% decline that, together with the widespread concerns about China's slowing economy, triggered volatility and sell-off globally. Indeed, global stocks quotation were already down about 3%-5% and selling orders on the E-Mini were hitting during the pre-opening market trading.

Given all these factors and the consequent volatility spreading, the NYSE decided to appeal to Rule 48[96] in order to quicken market openings in which it was a turbulent morning. The rule didn't require the quotation of a security neither to be announced nor to be endorsed by the stock market managers before the markets opening. If on one hand this should cut-off some activities that obviously require time, on the other it restrained the pre-opening information flow, fading price transparency in a critical moment. Despite the implementation of this ruling, the stock exchange experienced delays and almost the 50% of the listed stocks hadn't yet began normal trading at 9:40.

The lack of proper information and the time-gaps in many securities openings enhanced uncertainty in the stock market. holding back market makers to carry out their usual activity. Securities started to show big price divergences even though in the same sector and the price of some exchange traded products started to completely detach from their portfolios since arbitrage activity failed to take place[97].

Due to the heavy price swings and market imbalance at the opening, roughly 1.300 LULD trading breaks took place from 9:30 to 10:30 of that morning. It's worth to highlight that, if these pauses

[96] The Rule was abolished in 2016.
[97] BlackRock, 2015.

served as dampers for prices negative spikes, at the same time they slowed down prices recovery as the rule applied to both lower and upper bands. As we said, this caused further and subsequent halts, yet undermining price discovery and transparency, therefore. ETFs and ETPs in general represented one of the most affected categories: of the total number of trading halts, 1000 of them concerned ETPs.

LULD policies are not harmonized among the different stock exchanges and what played an important role in the creation of this loop were also the rules settled by the NYSE Arca; it represents the biggest U.S. ETFs exchange and the primary listing for more than the three-quarter of U.S. ETPs. Indeed, this exchange provides predefined auction collars in order to avoid securities opening or after-halt opening market prices to exceed a certain range. Problems arises when, due to these constraints, during periods of noisy markets and several trading imbalances, market orders are left unpaired and sent directly to the order books as soon as trading re-starts. On August 24 in particular, unfulfilled ETPs selling orders directly reversed on the order books led to greater volatility and further consequent LULD breaks.

Similarly to what happened during the 2010 Flash Crash, a broad number of ETFs experiences significant prices discrepancies with respect to their portfolios due to the absence of their underlying arbitrage activity. Indeed, arbitrageurs need proper market conditions to come into play as arbitrage is never riskless and they need some sort of "warranty" when entering the game.

First, they must be able to properly evaluate the ETPs shares with respect to their portfolios prices in order to understand if it does exist an arbitrage opportunity; this of course requires the underlying value to be available and certain intraday. After it's determined that arbitrage might be advantageous, market conditions need to allow for the possibility to hedge the arbitrage trading risk market participants are going to bear by taking a position on the ETPs i.e. markets need to be liquid. Arbitrageurs will unlikely participate if unable to protect their trades. Finally, they need to have the assurance their orders will be executed[98].

That morning all these requirements were missing since several assets quotations weren't available, causing troubles on properly judging the ETPs values tracking them, LULD halts were limiting disposable liquidity and the evaluation criteria regarding the clearly erroneous trades weren't straightforward. As a consequence, the arbitrage mechanism that usually keeps the ETFs prices

[98] BlackRock, 2015.

and their NAV aligned failed to take place for a broad number of securities and, as we anticipated several price discrepancies were observed.

The volume traded on this day spiked to one of the highest in U.S. equity and 37% of this were represented by ETPs shares[99].

The evidences brought out by the two flash crashes demonstrate that the arbitrage activity underlying ETFs and ETPs in general is not always effective in maintaining their market price and fundamental value aligned. Periods of high volatility and liquidity shortages have the potential to be disruptive for investors and the broad market, creating big inefficiencies.

In both shocks, large order imbalances, trading halts and broken trades enhanced the noise already spread in the exchanges and created further liquidity withdrawals, restraining the arbitrage activity and consequently the price discovery potential of these funds. Indeed, ETFs based on more liquid assets as large capitalization U.S. stocks, or the ones tracking unaffected securities as either bonds or international shares, which didn't experience any trading pause, maintained consistent prices with their underlying portfolios.

Among all the characteristics that make ETFs so popular and that we described in the first chapter, their greater liquidity in comparison with their underlying is surely one of the most appreciated by investors. This latter, together with market transparency is a necessary part of their tracking process. During the market history, as we reported in the second chapter, ETFs proved more than once their price discovery potential even when their components markets were closed; we need to bear in mind though, that arbitrage activity represents a fundamental part of this process.

Given the growing size of the ETFs industry, their increasing popularity in portfolios construction as diversification instruments due to their relevant characteristics and the influence they have on their underling portfolios considering their intrinsic cross-market activity, regulators should focus on creating more ad-hoc reforms for these instruments to ensure transparency, versatility and liquidity not to be undermined under both normal and critical market conditions.

[99] BlackRock, 2015.

IV. REGULATORY EVOLUTION AND MIFID II IMPACT

So far, we focused mostly on the US market of Exchange Traded Funds. The main reason for this choice relies on the size of it. In fact, US ETFs represented the 71% of the total AUM of the global industry as the end of 2017, in so far being the one having the highest and most meaningful amount of data. Moreover, the researches we've been analyzing are mainly focused on the SPDR S&P 500 since the biggest and most traded ETF in the world.

In this chapter instead, we are going to focus on the regulation of this industry in Europe since the latest developments and the recent implementation of the Markets in Financial Instruments Directive II represent a potential game changer for both markets.

1. EUROPEAN REGULATORY LANDSCAPE

US and European ETFs markets have been growing at the same pace in the recent years, performing an average 18% growth rate. Despite that, Europe still accounts only for the 16% of the global industry as a reflection of the main characteristics of this market.

Under European regulation, ETFs should fall below the rules instituted by the MiFID, being securities traded on the stock exchange. However, MiFID I was introduced in 2007, dealing with the guidance for credit institutions and investment firms providing financial services and for the market operations performed by market participants, it wasn't comprising ETFs as regulated instruments; consequently, there was no need for these funds to follow its legal requirements as, for example, the disclosure of the trading volume. The introduction of the MiFID II in 2018 was aimed to fix this discrepancy and later in this chapter we are going to focus on that[100].

The Undertaking for Collective Investment in Transferable Securities Directive gives the guidelines for ETFs activity, providing three important principles. First of all, as to preserve diversification, the holdings in the ETF portfolio cannot account for more than the 20% of the fund NAV each; secondly, supervised by an external custodian bank, the ETF and its provider need to separate their capital; finally, liquidity needs to be assured to the investor so that ETFs have to be open-ended and redemption has to be possible anytime. The UCITS authorization is a globally recognized guarantee that the fund is adopting high transparency and investors protection standards.

[100] Thomadakis, 2018.

In 2012, the European Securities and Markets Authority carried out the first initiative specifically directed to regulate ETFs, reinforcing their regulatory background and now requiring the disclosure of the ETFs portfolio transparency policy and secondary market investors risks in the fund prospectus. As an example, UCITS ETFs are required to display when and how the redemption of their shares is possible to be carried out directly with the fund and the eventual costs involved; this is usually allowed to secondary market traders only when big inefficiencies in the market appear and the absence of market makers cause the ETF market price to strongly differ from the NAV.

As anticipated before, the lag of the European ETFs market with respect to the United States, is due to some inner characteristics that have been observed developing over time. The fragmentation of ETFs in Europe around different stock exchanges, has been contributing to the slower development of the industry since too many funds are listed in an excessively high number of stock exchanges: although the 85% of the European ETF turnover is generated by 3 main markets (LSE, Euronext Paris and Euronext Paris, LSE and Deutsche Börse), 2.324 funds are scattered in 23 different exchanges while, the 2.173 U.S. ETFs are concentrated in only 3 stock exchanges.

Moreover, risk aversion and flexible pension plan systems are undermining the retail participation to the investment funds industry in general and, in particular, to the ETFs world: only the 10% of the European household financial assets is focused on collective investment schemes (22% in U.S.)[101].

Given that, retail investors attention is obviously more focused on instruments able to give a good competitive advantage in a transparent manner. As a consequence of the failure of ETFs classification as an asset class under MiFID I, and consequently no-obligation to report all the trading activity executed on them, led to the development of ETFs bilateral transactions rather than on-exchange trading. Over-the-counter ETFs trades are estimated to account for the 70% of the total industry, failing to provide to investors the transparency level they ask for[102].

Furthermore, exchange traded ETFs are still mostly used by institutional investors, as emerge by looking at the distribution of the EU exchanges transactions. In fact, the size of an average electronic order book transaction is way smaller than the ones occurring in negotiated deals. The main difference between those two types of transactions is that while the former are exposed to all market users and automatically executed within the rules set up by the exchange (minimum size as

[101] The biggest part of households' financial assets is focused for the 35% on currencies and deposits, 32% in insurances and pension funds and 20% invested in equity.
[102] Thomadakis, 2018.

an example), the latter consist in a common agreement between buyer and seller occurring in a parallel platform (managed by the stock exchange), that checks the consistency both with the exchange provisions and the EOB price.

On-exchange negotiated deals are mostly used by institutional investors in order to execute portfolio rebalancing or liquidity orders because they can interact directly with the counterparty avoiding commissions, in order to trade ETFs shares without any size constraint. On the other hand, EOB orders, being more regulated, benefit from greater transparency and are consequently preferred by retail investors. In Europe, ETFs EOB are the 12% of the size of the average ND transaction, while in U.S. the sizes are more similar, meaning that large retail and institutional investors are the one dominating the on-exchange venues[103].

2. MiFID II Implementation and Effect on European ETFs Industry

The recent introduction of MiFID II aims to bring more transparency on the European exchanges, focusing on equity and some equity-based instruments, including ETFs. The new combination of integrated rules aims to grant soundness and responsibility in more transparent financial markets, to take steps forward against unregulated financial systems, as a G20 commitment, to bring greater organization and transparency on OTC and commodities derivatives markets, to follow up financial innovations such HFT (High Frequency Trading), algorithmic and dark trading and to lower the member states discretion on financial markets regulation[104].

It's now possible to have a more consistent big picture of the trading volume of these instruments across Europe. The new reporting obligations require all the trades, both on and off exchange, to be reported and to be included in the consolidated tape[105]. Investors are now able to have a greater consciousness on the true liquidity of the ETFs market in Europe, considering that European stock exchanges sum up to 25 and ETFs can happen to be cross-quoted in multiple of them, showing different prices. Euronext estimated that in 2018 the ETFs visible exchanged volume grew from 1,3$ trillion to 2,3$ trillion[106].

[103] Thomadakis, 2018.
[104] Gomber et al, 2018.
[105] It's an electronic platform providing real time information on exchange traded securities volumes and prices.
[106] Bannon and MacManus, 2017.

MiFID II, providing also pre and post-trade transparency requirements, it's enhancing the investors' confidence in the ETFs industry as an efficient and liquid market. Moreover, the new imposition addressed to all the liquidity providers to register themselves as market makers has led to a 25% increase of this actors in Europe. Their networking is growing, creating a more efficient market: as we have seen, they are a fundamental part of the ETFs activity and greater is their presence inside the ETF industry, simpler will be to trade these instruments, i.e. greater liquidity[107].

As consequence of the greater transparency in the ETFs market, some authors sustain that these funds will be increasingly used in security lending activities from investors up to increase their revenues by taking more risk in their investments.

In addition, securities lending activities have been employing non-cash instruments as collateral more often in the past years, comprising ETFs; in Europe though, this usage has been limited by a common perception of poor liquidity. Because of the greater transparency in the European ETFs market and its real trading volumes finally coming into light, some authors sustain that banks, hedge funds and other institutional investors, will increasingly recognize these funds shares as a guarantee in Europe as well[108].

As we explained in the first chapter, the new regulation requires higher disclosure to funds, bank and financial advisors on the fees and retrocessions they ask to their clients. This is creating more awareness on the costs investors need to face and it's fastening the shift of the wealth management industry to a fee-based advisory model. Fee-based advisors are paid directly by the clients, usually based on the AUM, and they need to act respecting fiduciary obligations. This shift can further prompt the use of ETFs by advisors, as cost-efficient investment tools, perfectly suitable to build diversified portfolios[109].

Accordingly to all that has been said, the introduction of this new regulation is expected to boost the attractiveness of ETFs in Europe, both for retail and institutional investors. Even though not so much time has passed since the MiFID II implementation, ETFs providers have already started seeing some positive effect: in June 2018, the Head of BlackRock iShares EMEA Stephen Cohen, stated that, from only 6 months since the implementation of the regulation, the full range of iShares

[107]Chandler, 2018.
[108] Rust, 2018.
[109] Chandler, 2018.

UCITS ETFs has been experiencing a 61% increase in the trading activity and 74% for Fixed Income ETFs.

As we said, the new requirements imposed starting from January 2018, do not concern exclusively the disclosure of trading volumes. To ensure transparency both in the pre and post trading phase, market makers are required to disclose bid-ask spreads and details regarding each transaction done. However, MiFID II also involves the use of "waivers", in order to delay the publication of prices when large-volume trades or orders on less traded instruments are likely to heavily affect the price of the traded security. Besides the European Securities and Markets Authority defined the rules to compute such waivers for all the equity and equity-like financial instruments, they are claimed to be not suitable for ETFs. The main concern of market makers is that, due to inappropriate threshold they are not going to be able to use them in the right moment, causing large price fluctuation in ETFs prices.

In the last chapter we have found evidences on how ETFs trend are able to move the market of their underlying assets and how they create the base for common movements in their returns. Consequently, if big price fluctuations are not prevented to happen, they have the potential to spread all over financial markets, causing noise for non-fundamental reason. In addition, this risk might cause a loss of interest by investors more focused on price stability rather than higher returns. For example, many pension funds may decide to give up big volumes of ETFs shares, creating more prices pressure and triggering a dominos effect.

This is the reason why, if on one hand MiFID II is pushing the ETFs industry growth, on the other regulators need to closely follow-up its effect on the European market, ETFs in particular, given the financial stability risks it can be subject to[110].

The new developments in the European regulation might spread their effects overseas as well. Due to the lack of clarity about the real liquidity of European ETFs, investors often chose to direct their investments in comparatively more transparent jurisdiction i.e. U.S. market.

For example, aiming to shed more limpidity to the fees applied by asset managers, the new rules introduced by MiFID II expect the research expenses to be now sold and payed separately from trading expenses. This has caused a big change in the traditional market where banks and broker have always sold market analysis and research together with trading services, like a unique package.

[110] Bannon and MacManus, 2017.

Such development has the potential to lower trading costs, increase the quality of the researches and let investors to be more aware of how their money are spent, shifting their attention closer to the European market[111].

With higher trading efficiency and more consistent liquidity recording, investors should gradually lose the incentive to invest in overseas ETFs market, considering the advantage of European trading hours as well[112].

Moreover, the introduction of the KID requirement represents the most important growth opportunity for the European ETFs market. In fact, retail European investors are now forbidden from buying shares of a specific investment fund if the issuer is not providing the Key Information Document, i.e. a key document about the fund investment objectives, risk and reward strategies, applied fees and performance aimed to facilitate the potential client comparison of different products.

Consequently, for those investors it's now impossible to invest in the biggest and most popular ETFs in the world as the SPY, the QQQ (the PowerShares QQQ Trust Series 1 ETF tracking the Nasdaq 100) and the EEM (the iShares MSCI Emerging Markets ETF), that don't have a KID; they can either keep them or sell them if they already own some shares. Of course, the document is not impossible to be provided by the U.S. funds issuers but it requires the disclosure of different fund data as pricing information and time and since U.S. ETFs are not truly thought to be traded by European retail clientele there might be low motivation in creating this document.

Considering the size of these ETFs and the width of their clientele, the effect of this restriction won't be strongly impactful but, on the other hand, this can benefit European ETFs by further boosting the adoption of the region ETFs by non-professional investors[113].

Europe already has alternatives which investors can buy in order to overtake this limit as the SPY5 (SPDR S&P 500 UCITS ETF) or the CSPX (the iShares Core S&P 500 UCITS ETF USD). In this regard, the latter has hit a new record in 2018, becoming the biggest ETF domiciled in Europe with 30$ billion AUM. BlackRock Head of iShares EMEA explains that, among other factors like

[111] Bloomberg's Editorial Board, 2018.
[112] McNeil, 2018.
[113] Vannucci, 2018.

positive sentiments on U.S. stocks drove by strong earnings and growth, Also the introduction of MiFID II has of course played an important role in boosting in the inflow towards the CSPX[114].

Analysts estimate that European ETFs AUM have now the potential to grow up to 2$ trillion in a 5-years time[115].

One of the main reasons why the ETFs market in Europe has lagged behind the volumes of U.S. Exchange Traded Funds is because it has always comparatively lacked in transparency and integration. This caused these instruments to be mostly employed by institutional investors in OTC markets, wiping out an important part of the potential clientele, i.e. retail investors. Now that a new set of comprehensive European rules has been introduced to enhance investors protection and shade a light on this previously poorly regulated market, and that limits and improvements have been made with respect to foreign markets, many professionals think this is going to positively impact the ETFs industry of the continent.

So far, only one year has passed since the introduction of MiFID II and thorough analysis of the effect have still to be carried out; the biggest ETFs sponsor though, they have already begun to see the positive effect of the new rulings and the increase of new market makers is helping to further enhance the investors' confidence in the liquidity and the depth of this market.

More time will be needed to see the overall and complete consequences on European capital markets.

[114] Lord, 2018.
[115] Vannucci, 2018.

V. CONCLUSIONS

The financial industry has been subjected to several changes in the last years. Investors are shifting their investment strategies, now favoring passive investing, pushed by increasing information democratization, new regulatory frameworks, index proliferation, new automated investing platforms and mediocre active funds after-fees performances.

Among all the available instruments, ETFs have been the ones experiencing the greatest inflows and this comes with no surprise considering their intrinsic characteristics. These funds, besides their low fees and cost efficiency, they usually benefit from higher liquidity with respect to the securities they are tracking and from a good level of transparency since they need to disclose the components of their portfolios daily, opposed to other types of investment funds. They give to investors new opportunities of diversification by tacking positions in markets unavailable before and representing perfect building blocks for portfolio construction.

Their increasing popularity, in conjunction with their shares creation and redemption mechanism and intrinsic arbitrage activity, are giving some cause for concern though as potential threats to the stability of financial markets.

ETFs create two different trading levels, a primary venue involving transactions between the provider and the APs and a secondary between the APs and the global exchanges. This adds a further liquidity layer to the ETFs underlying assets that can result in two different consequences: when mispricing appears (conceived as the difference between the ETF price and its NAV) it either can be part of a price discovery process, enhancing information spreading, or it can propagate non-fundamental shocks from the fund to the securities when shocks take place.

In the second chapter we focused on answering our questions relating the ETFs potential for non-fundamental shocks spreading and underlying assets returns volatility.

Madhavan and Sobczyck demonstrated that during the 2008-2009 financial crisis, mispricing was caused by staleness in the NAV meaning that ETFs, as more liquid instruments, did the first move and the underlying assets followed. Similarly, during the Egyptian market closing for the Arab Spring, ETFs based on its stocks kept trading, giving investors consisting expectations on the further evolution of that market.

On the other hand, given that ETFs price dynamics are always driven by their intrinsic arbitrage activity, as opposed to the latter view, other academics conducted several researches demonstrating the existence of non-fundamental shocks transmission potential from the funds to their components as arbitrageurs take opposite position on them. The concern that ETFs can actually spread noise into their porfolios is even enhanced by the fact that in the recent years, ETFs have been increasingly employed for hedging and speculative aims.

The results obtained by David, Franzoni and Moussawi's study support this theory, showing that arbitrage activity is not only helping to keep the ETFs prices and their NAV aligned but it can represent a risk for financial markets since it has the potential to move the price of correctly-valued securities and consequently causing noise transmission and volatility in the underlings included in the ETF portfolio.

After finding evidences on the existence of a causal relationship between the ETFs ownership of a stock and its return volatility, the consequent question has been to wonder if, transmitting the same shock to all their portfolio, ETFs create commonality in their underlings returns behaviors.

Wurgler (2011) demonstrates that as a new stock is included in the S&P 500, its return pattern starts to move more alike the other securities included in the index portfolio, mainly due to the correlated money outflows and inflows the stocks experience after their inclusion Given that arbitrage activity has a stronger potential, with respect to correlated money flows, to drive returns commovement, in 2017 Da and Shive investigated on the existence of this latter link between ETFs portfolios inclusion and increasing similarity in the components returns behavior.

From their study it emerges that ETFs turnover, used as a proxy of ETFs arbitrage activity, represents a driver of correlation among stocks returns being itself correlated with stocks turnover throughout arbitrage activity. Bearing in mind that arbitrage is advantageous only when the securities involved can be easily and not expensively traded, as a further evidence favoring their theory, the two authors finds out that arbitrage activity has a greater influence on the correlation of the underlying assets returns for all the ETFs having their baskets made by more than the 99,67% of stocks.

Since ETFs can employ different approaches in order to track their underlings, we also asked if and in which way this can create threats to financial market stability. Indeed, the last part of the second chapter is focused on the risk represented by synthetic replication methods, as opposed to the effect that physical ETFs activity has on the funds underlying assets. While the investors on

the latter category are exposed to a tracking error risk, synthetic ETFs are exposed to a counterparty risk. Investors common perception of ETFs market as liquid can lead them to underestimate the market risk deriving from the increasing complexity of these products, also considering that when employing synthetic replication approaches, products transparency decreases since different players and markets come into play and risk monitoring ability decreases.

Relating to the two latter questions leading this work, in the third chapter we found evidences on the importance of market makers and institutional investors activity in maintaining ETFs efficiency, particularly with regards to the alignment between funds shares prices and their NAV.

In fact, different events in the recent history have demonstrated that ETFs can represent a risk for systemic financial stability, especially during time of market stress where liquidity shortages and limits to arbitrage activity starts to appear. During the Flash Crash happened in May 2010 for example, the S&P 500 sank roughly the 9% in 20 minutes, probably caused by the spreading of the unusual volatility. During this crash, ETFs have been the one category hit the most by the shock showing steep decline in prices and strong detachment from their underlings values. On this occasion, similarly to what happened in 2015 besides the new reforms taken by regulators, arbitrage activity failed to take place: due to poor liquidity, high volatility, prices uncertainty and low transparency, many market makers and other participants exited the market stopping to perform arbitrage activity.

The ETFs industry is growing, their popularity as diversification blocks in portfolios construction is increasing and given their influence on their underling assets due to their intrinsic cross-market activity and the reliance investors have on their liquidity, regulators should focus on the preservation of ETFs transparency, versatility and liquidity under both normal and critical market conditions.

The recent implementation of MiFID II in Europe has the objective to shade a light on this sector. Increased regulation, greater disclosure and a higher number of market makers is helping to further enhance the investors' confidence in the liquidity and depth of this market and even though only one year has passed by, ETFs sponsor have already started to see positive effect in the sector inflows.

ETFs are one of the most innovative financial instruments. They give investors new opportunities for diversification and can be elements of price discovery at times. Their virtues come with some flaws and risk though, mostly related to their intrinsic mechanics. Regulations and reforms can

provide a protection against the inefficiencies these instruments can bring to the market and their potential for noise spreading but the underlying risk represented by liquidity shortages and arbitrage activity failure will be hard to defeat. For this reason, investors should be cautious and perfectly aware of this industry characteristics.

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