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The EDHEC European ETF and Smart Beta and Factor Investing Survey 2018

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The present survey aims to provide insights into investor perceptions on exchange-traded funds (ETFs) and smart beta and factor investing strategies. While there is ample discussion by market participants on these high-growth areas of asset management and industry data is widely available, conducting a survey allows us to gather a systematic and quantified account of investors' views, experiences and future plans. We thus hope to provide useful insights, building on analysing the current responses and relating them to past results of our regular surveys.

Our survey gathered information from 163 European investment professionals concerning their practices, perceptions and future plans. Our respondents are high-ranking professionals within their organisations (37% belong to executive management and 33% are portfolio managers),[1] with large assets under management (36% of respondents represent firms with assets under management exceeding €10bn).[2] Respondents are distributed across different European countries, with 17% from the United Kingdom, 69% from other European Union member states, 13% from Switzerland and 1% from other countries outside the European Union.[3]

Analysis of responses to our survey allowed us to shed light on several important questions regarding investor perceptions on ETFs. Moreover, we gain insights into the perceived benefits and challenges with smart beta and factor investing strategies. In fact, we find that adoption of such approaches is still partial despite a decade of discussion in the industry, with the vast majority of adopters investing less than 20 per cent of their portfolio in such approaches (see exhibit 4.24 in Section 4, Results). It was therefore interesting to better understand the challenges investors face when analysing such strategies. Our survey points to the important shortcomings of current smart beta offerings, which may explain the slow adoption by industry participants. For example, investors perceive a lack of transparency and difficulty in accessing information on such strategies, in particular on risk categories such as data-mining risks. In the case of fixed-income strategies, investors express doubts over the maturity of research results at this stage. Investors also see a need for further developments of long/short equity strategies based on factors, strategies that address client-specific risk objectives, and strategies that integrate environmental, social and governance (ESG) considerations. Smart beta researchers and product providers doubtlessly have to work on improving their solutions for smart beta and factor investing strategies to make it into the mainstream. Below, we provide a summary of our results by emphasising the key conclusions of our survey.

1 - See Exhibit 3.3 in Section 3 (Methodology and Data).
2 - See Exhibit 3.5 in Section 3 (Methodology and Data).
3 - See Exhibit 3.1 in Section 3 (Methodology and Data).
4 - One should refer to John C. Bogle, who declares that ETFs are "just great big gambling, speculative instruments that have definitely destabilized the market" (Zweig, 2011) and who argues that ETFs distract investors from long-term investing because they can be traded so easily (Benz, 2011).

1. How do Investors Select and Use ETFs?

1.1. What is the dominant purpose of ETF usage?

Our survey results clearly indicate that the current usage of ETFs is dominated by a truly passive investment approach. Despite the possibilities that ETFs offer – due to their liquidity – for implementing tactical changes, they are mainly used for long-term exposure.[4] Some 61% of respondents use ETFs for buy-and-hold investments, while only 45% of them use ETFs for tactical bets

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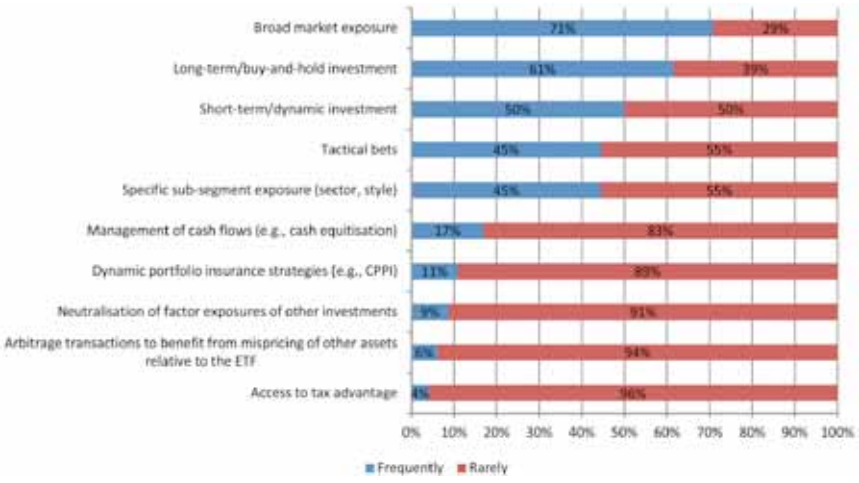
(see Exhibit 1). Looking at trends about ETFs usage in our successive surveys from 2009 (the first year respondents were asked about it[5]), it appears that the use of ETFs for buy-and-hold investments has remain quite stable at over 60% since 2012.

Moreover, despite the intense product development, which has led to available products for a multitude of sub-segments of the markets (sectors, styles etc.), gaining broad market exposure remains the main focus of ETF users. As seen in Exhibit 1, 71% of respondents use ETFs to gain broad market exposure, versus 45% who use ETFs to obtain specific sub-segment exposure (sector, style). While some variations were observed for those figures over the period from 2009 to 2018,[6] the values obtained in 2018 are equal to the long-term mean. The preference for broad market exposure is even more pronounced when looking at answers for specific asset classes, where we see that 92% of respondents use broad market ETFs for equity investments, and 74% and 79% of respondents use broad market ETFs to invest in government bonds and corporate bonds, respectively.[7]

Consistent with this desire to use ETFs for passive exposure to broad market indices, respondents show little appetite for seeing discretionary active strategies delivered in an ETF wrapper. In fact, with 15% of respondents mentioning it,[8] actively-managed strategies are one of the least desired categories when we asked about their wishes for future product development in the ETF space. In line with this expression of conservatism in their use of ETFs, which is mainly focused on traditional passive management, it can also be noted that investors are largely satisfied by ETFs in traditional asset classes but more reserved about ETFs for alternative asset classes. While 97% and 92% of respondents are satisfied with their use of ETFs to invest in equities and government bonds, respectively, only 17% are satisfied with their use of ETFs for hedge funds.[9] It thus appears that, while ETFs indeed offer numerous possibilities to move beyond traditional passive investing, the principal use of ETFs for traditional asset classes remains long-term investing in broad market indices.

5 - See Exhibit 4.18 in Section 4 (Results).
6 - See Exhibit 4.18 in Section 4 (Results).
7 - See Exhibits 4.3 to 4.5 in Section 4 (Results).
8 - See Exhibit 4.10 in Section 4 (Results).
9 - See Exhibit 4.7 in Section 4 (Results).

Exhibit 1: How Often do you Use ETFs for the Following Purposes?
This exhibit indicates the frequency of respondents using ETFs for each of the mentioned purposes. Respondents were asked to rate the frequency from 1 to 6. The "frequent" category would include ratings from 4 to 6 and "Rarely" would take into account ratings from 1 to 3 and non-responses.



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1.2. What are the future growth drivers?

The European ETF market has seen tremendous growth over the past decade or so. At the end of December 2017, the assets under management (AUM) within the 1,610 ETFs constituting the European industry stood at $762bn, compared with 273 ETFs amounting to $94bn at the end of December 2006 (ETFGI, 2017). While such growth can be observed ex post from market data, our survey allows us to assess the drivers of such growth and the intentions of future ETF adoption by respondents. A remarkable finding from our survey is that a high percentage of investors (50%) still plan to increase their use of ETFs in the future, despite the already high maturity of this market and high current adoption rates.[10] We thus observe a remarkably persistent tendency for future growth. It is interesting to analyse the reasons behind this trend. Several interesting results appear from our survey responses in terms of growth drivers in the ETF market. First, a clear finding is that lowering investment cost is the primary driver behind investors' future adoption of ETFs for 86% of respondents in 2018 (which is an increase from 70% in 2014).[11] However, investors are not only planning to increase their ETF allocation to replace active managers (70% of respondents in 2018), but are also seeking to replace other passive investing products through ETFs (45% of respondents in 2018).[12]

10 - See Exhibit 4.19 in Section 4 (Results).
11 - See Exhibit 4.21 in Section 4 (Results).
12 - See Exhibit 4.20 in Section 4 (Results).

1.3. How do investors select ETFs?

Our survey provides direct evidence of the criteria investors use for selecting ETF providers. Two criteria dominate investors' preoccupations. The first one is costs, with a vast majority of respondents (89%) mentioning it. The second one is the quality of replication, with more than four-fifths of respondents (83%) considering this criterion when selecting an ETF provider. These results are not surprising as these two criteria are related to the main motivations for using ETFs, namely reducing investment costs, while tracking the performance of the underlying index. It should be noted that cost and replication quality are two criteria that are easy to ground on an analytic basis of measurement of results, which may also be product-specific rather than provider-specific. It is worth noting that such measureable product qualities are in the foreground of investor preoccupations. On the other hand, more potentially subjective quality criteria associated with a provider play a lesser role. With 41% and 38% of respondents, respectively, long-term commitment of the provider and broadness of the range are two criteria that still play a reasonable role for respondents when choosing an ETF provider. However, with only 20% of respondents mentioning it, innovation seems to be of less importance. Finally, complementing the active offering of the provider appears to be important for only 5% of respondents (see Exhibit 2). Given that the key decision criteria are more product-specific and are actually "hard" measurable criteria, while "soft" criteria that may be more provider-specific have less importance, competition for offering the best products can be expected to remain strong in the ETF market. This implies that it will be difficult to build barriers of entry for existing providers unless they are related to hurdles associated with an ability to offer products with low cost and high replication quality.

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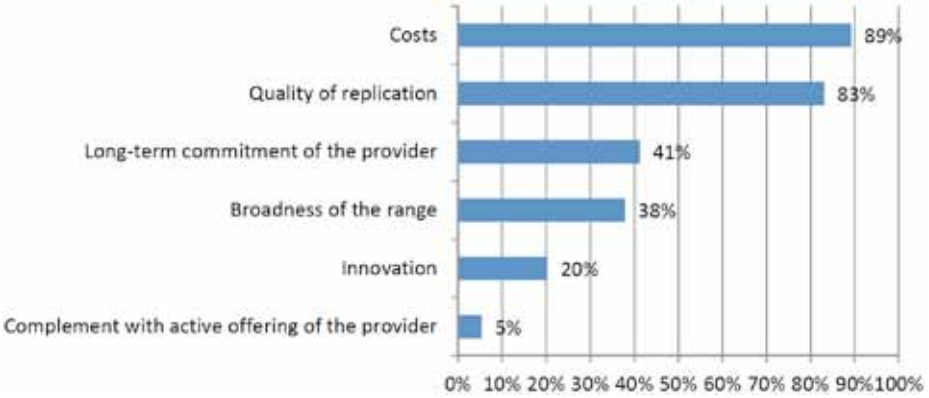
Exhibit 2: What Criteria do you Consider when Selecting an ETF Provider?
This exhibit indicates the criteria respondents consider when selecting an ETF provider. More than one response can be given.



2. What are the Key Objectives Driving the Use of Smart Beta and Factor Investing Strategies?

2.1. What are the motivations and growth prospects for smart beta and factor investing strategies?

Smart beta and factor investing strategies have continuously been in the spotlight in recent years and the increasing investor interest is obvious. Our survey allows some light to be shed on the drivers behind this interest and the actual usage of smart beta and factor investing strategies among investors. A first important result is that the quest for outperformance is the main driver of interest in smart beta and factor investing. In fact, 73% of respondents agree that smart beta and factor investing indices offers significant potential for outperformance.[13] Moreover, the most important motivation behind adopting such strategies is to improve performance. On a scale from 0 (no motivation) to 5 (strong motivation), respondents give an average score of 3.76 to 'Improve performance', far ahead of other motivations that obtain scores from 1.52 (Address regulatory constraints) to 3.29 (Manage risk).[14] The latter, which is in second position among key motivations, is also an important element of choice when it comes to smart beta and factor investing strategies. However, despite this strong motivation to use smart beta and factor investing strategies to seek performance improvements, the actual implementation of such strategies is still at an early stage, according to information from our respondents on their current and future usage. In fact, while 46% of respondents currently invest in smart beta and factor investing strategies, another 28% do not but do are considering adopting such strategies in the future.[15] Moreover, among those respondents who have made investments in smart beta and factor investing strategies, these investments typically make up only a small fraction of portfolio holdings. More than four-fifths of respondents (83%) invest less than 20% of their total investments in smart beta and factor investing strategies and only 11% of respondents invest more than 40% of their total investments in smart beta and factor investing strategies.[16] This low intensity of usage of factor indexing ultimately means that investors – even if they have adopted factor investing – do not fully capture the benefits as of today. It is perhaps surprising that almost a decade after the influential report on Norway's Sovereign Wealth Fund (see Ang, Goetzmann and Schaefer,

13 - See Exhibit 4.34 in Section 4 (Results).
14 - See Exhibit 4.46 in Section 4 (Results).
15 - See Exhibit 4.23 in Section 4 (Results).
16 - See Exhibit 4.24 in Section 4 (Results).

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2009), which emphasised the benefits of factor investing for investors, adoption of such an approach remains partial at best. However, the growth trend in adoption of such strategies is intact. When asked about their use of smart beta and factor-based investment products in terms of assets over the near future, 48% of respondents indicate an increase of more than 10% while only 3% indicate a decrease.[17]

2.2. How do investors implement smart beta and factor investing strategies?

Our survey allows for several insights into how investors implement their smart beta and factor investing strategies and their exposure to desired factors. In terms of the actual product wrapper used for smart beta and factor investing exposure, respondents favour passive funds that replicate smart beta and factor investing indices (63% of respondents) but also use active solutions, i.e. approaches including a significant amount of discretion, albeit to a lesser extent (49% of respondents).[18]

Our survey also analyses how investors rate passive replication of smart beta and factor investing indices and discretionary smart beta and factor investing strategies on a range of criteria. If we look how respondents rate the list of advantages of each smart beta and factor investing strategy category, it appears that both of them obtain the same score for the 'Possibility to create alignment with investment beliefs' (74%). In addition, discretionary strategies are preferred for the reactivity/dynamism they offer, with 73% of respondents indicating both the 'Ease of use as building blocks in portfolio allocation' and the 'Ease to change portfolio allocation over time' as the second and second ex-aequo advantages.[19] Replication of smart beta and factor investing strategies is also chosen for another five reasons for at least 70% of respondents: 'Mitigating possible conflict of interest provider vs. investor' (73%), 'Availability of information for assessing strategies' (72%), and 'Broadness of the available solutions' (72%), 'Ease to change allocation over time' (71%) and 'Costs' (70%).[20] While passive replication of indices is seen as more advantageous on a majority of criteria, the differences in perception across the two approaches are most notable in specific areas. The biggest advantage of replicating indices over using discretionary strategies is seen in the area of 'Mitigating conflicts of interest between provider vs. investor' (73% of respondents see it as an advantage for replication of smart beta and factor investing strategies, while 54% see it as an advantage for discretionary smart beta and factor investing strategies) and the 'Broadness of the available solutions' (72% of respondents see it as an advantage for the replication of smart beta and factor investing strategies, while 58% see it as an advantage for discretionary smart beta and factor investing strategies).[21] However, discretionary strategies are seen as having an advantage over index replication when it comes to the 'Ease of use as building blocks in portfolio allocation' (73% for discretionary smart beta and factor investing strategies, versus 64% for replication of smart beta and factor investing strategies[22]), undoubtedly due to the fact that most indices available today are rather standardised.

Our survey also allows us to differentiate between the types of uses respondents make of their factor exposure. It appears that the most frequent use respondents

17 - See Exhibit 4.43 in Section 4 (Results).
18 - See Exhibit 4.26 in Section 4 (Results).
19 - See Exhibit 4.27 in Section 4 (Results).
20 - See Exhibit 4.28 in Section 4 (Results).
21 - See Exhibit 4.29 in Section 4 (Results).
22 - See Exhibit 4.29 in Section 4 (Results).

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have of factor-based exposures is the 'Strategic use to harvest long-term premia' (score of 3.31 on a scale from 0, no use, to 5, highly frequent use). However, the least frequent approach in use today is 'Tactical use based on macroeconomic regimes' (score of 1.98 on a scale from 0, no use, to 5, highly frequent use).[23] These results suggest that the implementation of a factor-based strategy rarely aims at factor return timing and much more frequently targets the extraction of long-term premia.

2.3. What is the position of investors in smart beta and factor investing strategies for fixed-income?

This year, we introduce a special focus on smart beta and factor investing for fixed-income. The results of our survey show that 17% of the whole sample of respondents already use smart beta and factor investing for fixed-income.[24] Some 80% of this sub-sample of respondents invest less than 20% of their total investment in smart beta and factor investing for fixed-income.[25]

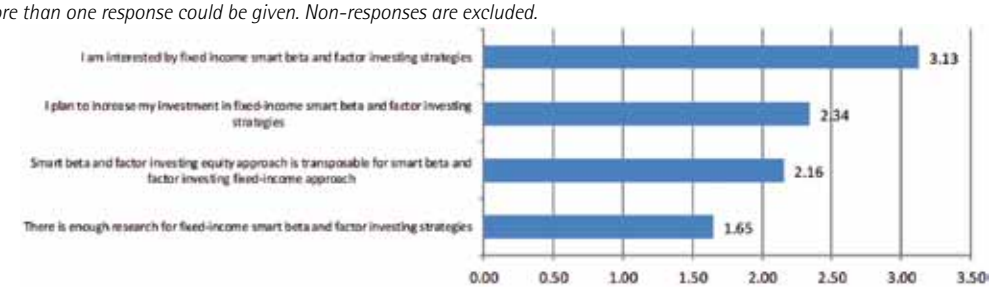
It appears that respondents show a significant interest for smart beta and factor investing for fixed-income, as their average score with this statement is 3.13 on a scale from 0 (strongly disagree) to 5 (strongly agree). However, there is a significant gap between the interest in this investment and the forecast of an increase in it, as the average score of agreement with planning to increase investment in smart beta and factor investing for fixed-income, is only of 2.34. There are straightforward explanations for this gap. First, the average score of agreement with the statement that smart beta and factor investing approaches developed for equity investing are transposable to fixed-income is only of 2.16; second, respondents do not consider there to be enough research in the area of smart beta and factor investing for fixed-income (average score of 1.65) (see Exhibit 3). Overall, it thus appears that investors are doubtful that research on factor investing in fixed-income is sufficiently mature at this stage. Given the strong interest in such strategies indicated by investors, furthering research in fixed-income factor investing is a promising venture for the industry.

2.4. Do investors have the necessary information to evaluate smart beta and factor investing strategies?

The results of our survey suggest that the transparency of smart beta and factor investing strategies is a key component of their appeal. Some 90% of our respondents declare that smart beta and factor investing indices require full transparency on methodology and risk analytics.[26] However, our respondents also cited a lack of

23 - See Exhibit 4.42 in Section 4 (Results).
24 - See Exhibit 4.30 in Section 4 (Results).
25 - See Exhibit 4.31 in Section 4 (Results).
26 - See Exhibit 4.37 in Section 4 (Results).

Exhibit 3: Opinion of Respondents about Statements Concerning Smart Beta and Factor Investing for Fixed-income.
This exhibit indicates the agreement of respondents with the statement on a scale from 0 (strongly disagree) to 5 (strongly agree). More than one response could be given. Non-responses are excluded.



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transparency as the second most important hurdle to increasing smart beta and factor investing investments.[27] To analyse the question of transparency and lack thereof in detail, we asked respondents about the information they consider important to assess smart beta and factor investing. At the same time, respondents were asked whether they considered this information to be easily available. Their responses thus allowed us to assess the gap between required information and ease of access to this information (see Exhibit 4).

It is interesting to see the spread between the importance of and the accessibility to this information. It appears that the highest spread is observed for information respondents considered as crucial. For example, data-mining risk and information about transparency on portfolio holdings over a back-test period are two crucial pieces of information for respondents, with scores of 3.63 and 3.85, respectively. Data-mining risk is also the piece of information that appears to be the most difficult to obtain for respondents, with a score of 2.21, while information about transparency on portfolio holdings over a back-test period is among the three most difficult pieces of information to obtain, with a score of 2.49. Liquidity and capacity, which is the most important piece of information for respondents, with a score of 4.06, is also information relatively difficult to obtain, with a score of 2.92. Indeed, when we consider the gap between information importance and its availability,[28] information about liquidity and capacity comes in fourth in terms of importance of gap, after data-mining risk, transparency on portfolio holdings and sensitivity of performance to strategy specification choices. Even relatively basic information such as the index construction methodology is not judged to be easily available (score of 3.25) relative to its importance (score of 4.01). On the contrary, information about recent performance and risk over the past 10 years is among the least important for respondents with a score of 3.36, but it is also one of the most easily available, exhibiting one of the highest scores (3.22) across the board in terms of availability. The gap between information importance and its accessibility as seen by investors is displayed in Exhibit 4.

The fact that information that is regarded as important is not considered to be easily available clearly calls into question the information provision practices of smart beta and factor investing providers. In fact, the only area in which no pronounced gap exists between the importance and the ease of accessibility scores is for recent performance numbers. Performance and risk information is judged to be moderately easily available and moderately important. All other areas show pronounced gaps between these two metrics. Two of the three items that are judged to be the least easily available are holdings over the back-test period and data-mining risks. Interestingly, both these items rank much higher on the importance score for investors than, for example, recent performance. Moreover, there is a pronounced gap of 0.87 between importance of information items and their ease of accessibility, as shown by the means of their respective scores (3.70 and 2.83, respectively). Overall, though the gap has narrowed compared to 2016, these results suggest that there is still room for further improvement, as investors still do not believe that information considered

27 - See Exhibit 4.47 in Section 4 (Results).
28 - See Exhibit 4.40 in Section 4 (Results).

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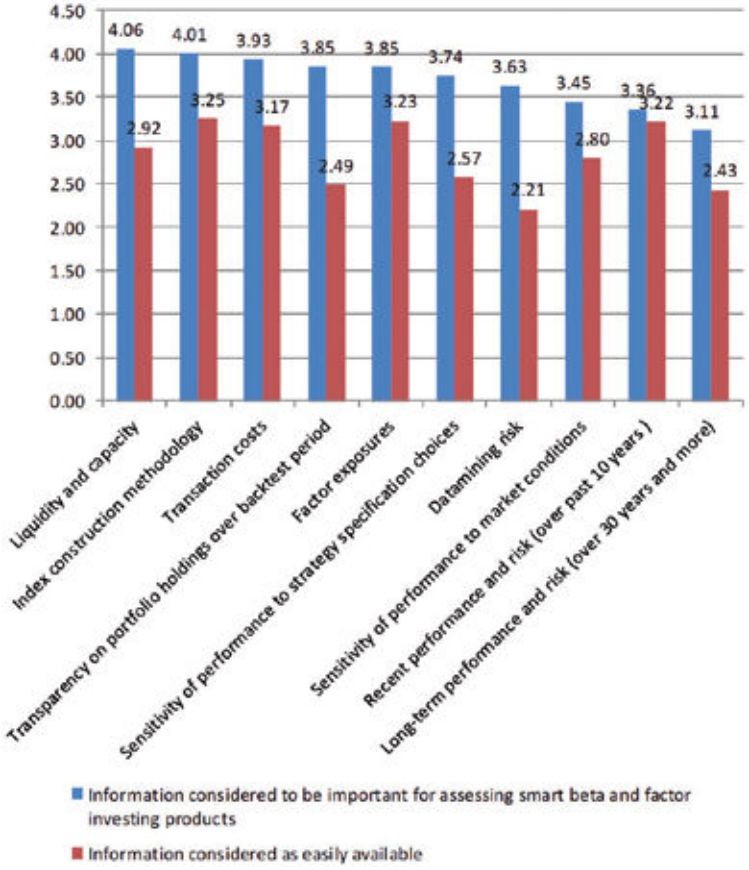
Exhibit 4: Information About Smart Beta and Factor Investing Products
This exhibit indicates the information respondents consider important for assessing smart beta and factor investing products on a scale from 0 (not important) to 5 (crucial) and which information they consider to be easily available on a scale from 0 (difficult to obtain) to 5 (easy to obtain).



important for assessing smart beta and factor investing strategies is made available to them with sufficient ease.

2.5. What requirements do investors have about smart beta and factor investing strategy factors?

From the results of our survey, it appears that respondents are primarily concerned with the documentation of the factor premium in extensive empirical literature (with a score of 3.74), closely followed by the existence of a rational risk premium (with a score of 3.73), and then by ease of implementation and low turnover and transaction costs, (with a score of 3.68) – see Exhibit 5 for detail. The existence of a rational explanation for factor risk premia is of principal importance to investors as it is probably related to the fact that a rational explanation suggests that the premium will be persistent. Indeed, if the literature interprets the factor premia as compensation for risk, the existence of the factor premia could also be explained by investors making systematic errors due to behavioural biases such as over- or under-reactions to news on a stock. However, whether such behavioural biases can persistently affect asset prices in the presence of some smart investors who do not suffer from these biases is a point of contention. In fact, even if the average investor makes systematic errors due to behavioural biases, it is still possible that some rational investors who are not subject

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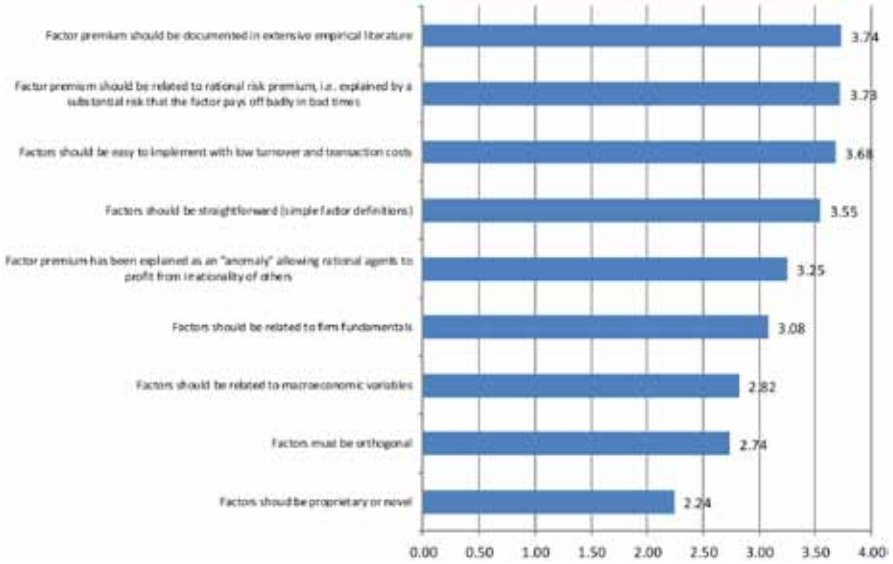
Exhibit 5: Requirements About Factors
This exhibit indicates the requirements respondents have in order to consider a given set of factors in their investment approach on a scale from 0 (not important) to 5 (absolutely crucial).



to such biases might exploit any small opportunity resulting from the irrationality of the average investor. The trading activity of such smart investors may then make the return opportunities disappear. Therefore, behavioural explanations of persistent factor premia often introduce so-called "limits to arbitrage", which prevent smart investors from fully exploiting the opportunities arising from the irrational behaviour of other investors.

3. Future Developments

3.1. What are investor expectations for further development of ETF products?

Our survey allows us to define a bit more clearly the type of niche markets where investors would like to see further ETF product development. As shown in Exhibit 6, the top concerns for respondents are the further development of Ethical/Socially Responsible Investing (SRI) ETFs, with 34%, as well as emerging market equity ETFs and emerging market bond ETFs, with 32% and 31%, respectively. Additionally, for ETFs related to advanced forms of equity indices – namely those based on smart beta and on multi-factor indices – 27% and 25% of respondents, respectively, wished for further developments in these two areas. Moreover, if we aggregate the responses concerning smart beta indices, single-factor indices and multi-factor indices, we note that more than two-fifths of the respondents (42%) want further developments in at least one of these categories related to smart beta equity or factor indices. This shows that the development of ETFs based on advanced forms of equity indices is now by far the highest priority for respondents. Alternatively, if we use our survey results to look at trends over time concerning the demand for ETFs based on emerging market equity, we see that a strong decline began in 2012, when 49% of respondents were demanding additional developments in this area – a percentage that had been relatively stable since 2006. Now that it lies at 32% in 2018, it seems that a share

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of respondents have shifted their demands from developments in emerging market equities to new forms of indices.

Regarding the further demand for ETFs based on smart beta indices, which shows a strong interest of respondents in alternative indices, the result is interesting as there have been a considerable number of smart beta and factor investing ETF product launches (see Section 2.2 on smart beta strategies and factor investing in the Background section of this document). The fact that more than a quarter of investors still see room for further product development may be explained by the fact that product launches have focused on relatively few popular strategies thus accounting for a small number of risk premia, such as the value premium and defensive equity strategies.

We also note that additional demand for ETFs based on smart bond indices is not so far behind, with 23% of respondents mentioning it, respectively. This should be put in perspective with the high interest of respondents in smart beta and factor investing for fixed-income (see Exhibit 3).

3.2. Expectations on future development for smart beta and factor investing products

Finally, respondents were asked about the smart beta and factor investing solutions they think required further product development from providers. Our survey results indicate that respondents desire further development in the area of fixed-income, as well as in alternative asset classes, which is not surprising as smart beta and factor investing strategies were initially developed for equity investment (see Exhibit 7). On a scale from 0 (no further developments required) to 5 (further developments required with strong priority), fixed-income smart beta and factor investing strategy solutions obtain a score of 3.54. This result should be considered

Exhibit 6: What Type of ETF Products Would You Like to See Developed Further in the Future?
This exhibit indicates the percentage of respondents who would like to see further development in the future for different ETF products. Respondents were able to choose more than one product.

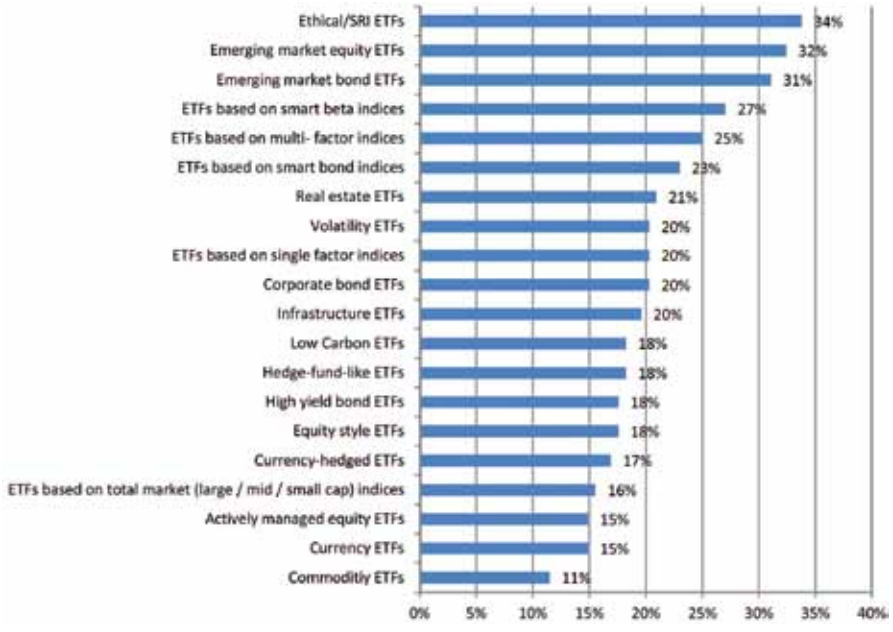

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Exhibit 7: Which Type of Solutions Do You Think Require Further Product Development from Providers?
This exhibit indicates the types of solutions requiring further products developments from providers on a scale from 0 (not required) to 5 (strong priority). More than one response could be given. Non-responses are excluded.

in parallel with those displayed in Exhibit 3, showing an increase interest for these products but still with a limited share restricted to it. Integration of ESG in smart beta and factor investing, and strategies in alternative asset classes (currencies, commodities, etc.), closely follow with a score of 3.12 and 3.01, respectively. The three other proposals, namely long/short equity strategies, solutions addressing specific investor objectives, and products offering exposure to novel factors, obtained scores in comparing range (2.68, 2.67 and 2.55, respectively). So, there is still a lack of products when it comes to asset classes other than equity, and this lack is particularly critical for the fixed-income asset class, which is largely used by investors. It is likely that the development of new products corresponding to these demands may lead to an even wider adoption of smart beta and factor investing solutions.

1. Introduction

1. Introduction

The present survey aims to provide insights into investor perceptions on exchange-traded funds (ETFs) and smart beta and factor investing strategies. While there is ample discussion by market participants on these high-growth areas of asset management and industry data is widely available, conducting a survey allows us to gather a systematic and quantified account of investors' views, experiences and future plans. We thus hope to provide useful insights, building on analysing the current responses and relating them to past results of our regular surveys.

Since 2006, EDHEC has annually conducted a survey on European investors' views and uses of ETFs. Since 2013, in view of the considerable development of smart beta and factor investing strategies over recent years, additional questions have been added, asking survey participants to share their opinions on products that track smart beta and factor investing indices. In the present edition of the survey and as in the previous edition, we dedicate a large group of questions not only to these smart beta and factor investing ETFs, but also to investors' general use and opinion of smart beta and factor investing strategies. This survey brings together the main vehicles of passive investment, namely ETFs – which are standard and very liquid products that track indices – and strategies based on the new forms of indices.

ETFs are perhaps one of the greatest financial innovations of recent years. Unlike conventional index funds, ETF units trade on stock exchanges at market-determined prices, thereby combining the advantages of mutual funds and common stocks. Most of them represent passive instruments designed to track the performance of a financial index as closely as possible.

Like any other exchange-traded product (ETP), the prices of ETFs are determined by the corresponding supply and demand. Thus the price may deviate below or above the net asset value (NAV). However, ETFs are characterised by a transparent and fluid share-creation process that ensures that the price remains close to the NAV. In fact, if an ETF appears to be undervalued compared to its NAV, then an arbitrager can buy the ETF units, redeem them at the custodian bank for the underlying securities and sell them on the market, thus making a profit.[29]

The first European ETF came on the market only in 2000 and encountered a large development since then. Assets under management (AUM) of ETFs and other exchange-traded index products amounted to $762bn as at the end of December 2017 (ETFGI, 2017). In 17 years, ETFs have become a serious alternative to other financial products, such as futures or index funds, which allow participation in broad market movements. And the ETF market is still growing: while the first ETFs attempted to replicate the performance of broad equity markets, ETFs now exist for a wide range of asset classes including fixed-income, currencies and commodities, and within each asset class ETFs are venturing into covering more precise sub-segments (such as segments by yield or liquidity/size of securities) or employing innovative index construction methodologies (such as alternative weighting schemes or factor tilts). Another focus of innovation has been to offer more varieties of equity ETFs with similar economic exposure and to

29 - The indicative NAV (iNAV) is published intraday and can be compared to the price of the ETF almost in real time.

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provide detailed choices of how to gain this exposure, such as equity ETFs with different distributing share classes[30] and ETFs on currency-hedged indices. Multi-asset ETFs also come to the stage, such as ETFs that replicate the portfolios containing both equities and bonds.

The development of readily-accessible index investment products may have positive effects for investors. In fact, recent research (Cremers et al., 2013) suggests that the prevalence of index replication products improves the levels of competition and efficiency of the fund management industry. At the same time, the rapid growth and innovation within the ETF market has led investors to closely examine the potential risks of ETFs. Recently, the standard practice of using a capitalisation-weighting scheme for the construction of indices has been the target of harsh criticism. Nowadays, growing demand for indices as investment vehicles has led to innovations including new weighting schemes and alternative definitions of sub-segments. There are also many recent initiatives for non-cap-weighted ETFs. These have been coined "Smart Beta ETFs" as they seek to generate superior risk-adjusted returns compared to standard market-capitalisation-based indices. The broad aim of this survey is to analyse the current practices and perceptions among ETF users in Europe, as well as among smart beta and factor investing strategy users. By comparison of our results to those of our previous surveys, we aim to shed some light on trends within the ETF market and within smart beta and factor investing strategy offer.

The EDHEC European ETF and Smart Beta and Factor Investing Survey 2018 took the form of an online questionnaire addressed to European professionals in the asset management industry. The survey targeted institutional investors as well as asset management firms and private wealth managers. The questionnaire consists of one section covering the role played by ETFs in the survey respondents' asset allocation decisions, as well as their views on the future developments in the ETF market. In a second section, respondents were asked to give their opinions about products that track smart beta and factor investing indices, and more generally on alternative equity beta strategies, as well as on smart beta and factor investing for fixed-income, in relation to the recent considerable development in these types of indices.

This survey proceeds as follows. Section 2 presents the Background section of the survey, which is made up of two parts. In the first part, we review the European ETF market and explain this financial product in more detail. The second part of the Background section is dedicated to smart beta and factor investing strategies. The methodology used to conduct the survey and some information about survey respondents is described in Section 3. Results of the survey are detailed in Section 4, which, similarly to the Background section, is divided in two parts. The first part is dedicated to ETFs, including European investors' views on ETFs, their present uses of ETFs, and the future developments they wish to see. The second part is entirely dedicated to investor views on smart beta and factor investing strategies and their desired areas for further improvement.

30 - For instance, Amundi ETF Euro Stoxx 50 has two distributing share classes: capitalising and dividend distributing. UBS ETF MSCI Emerging Markets TRN Index has institutional and retail share classes.

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2.1. ETFs

2.1.1. Overview of ETFs

ETFs are open-ended investment funds traded on a stock exchange. The first ETFs appeared in the United States in 1989 and they started trading in Europe in 2000. As at the end of December 2017 there were 5,311 ETFs worldwide managing $4,661bn in assets (ETFGI, 2017). The AUM within the 1,610 exchange-traded funds constituting the European industry stood at $762bn from 52 providers on 26 exchanges (ETFGI, 2017). While the large number of ETFs means that a large variety of indices are tracked – including indices on niche markets and innovative index methodologies on traditional asset universes – there is also a large choice of different ETFs that track the same or very similar indices. In Europe, at the end of February 2018, there were 18 ETFs that track the Euro Stoxx 50 index[31] for example. ETFs and other ETPs are still heavily oriented towards equity. At the end of December 2017, equity products account for about 67% of AUM in European ETFs and ETPs, fixed-income products account for about 23.5% of assets, while commodity products and ETFs and ETPs providing other types of exposures including multi-asset class exposures, currencies and alternative asset classes, account for about 9.5% (BlackRock, 2017).

The European ETF market is mostly institutional. Although there are not exact figures, industry estimates in terms of the percentage of retail AUM range from 10% to 15%, according to Morningstar (2017). The European Securities and Markets Authority (ESMA) Securities and Markets Stakeholder Group[32] notes that while ETFs are a "very low cost alternative" to other Undertakings for Collective Investment in Transferable Securities (UCITS) funds, they are "very rarely, if at all, marketed for European individual investors" due to "differences in remuneration of the distribution channels".

In continental Europe, retail distribution has traditionally been controlled by banks, and to a lesser extent insurance companies, who have used their sales to market almost exclusively their in-house products. In 2015, 56% of the AUM in the European fund industry was controlled by third-party allocation and 44% by captive distribution channels (Giannotti and Maciver, 2016). However, the split is different from one country to another, with a dominance of captive distribution in Austria, France, Italy and Spain, while Sweden, UK and Netherlands use more third-party funds. In the United Kingdom, independent financial advisers (IFAs), dominate the retail market. Until now, these institutions and intermediaries have no direct incentive to promote ETFs, which by nature do not pay them commissions, unlike comparable unlisted vehicles, UCITS included. However, the introduction of the second Markets in Financial Instruments Directive (MiFID II) in January 2018 will end this distribution commission policy for independent advisers, which will benefit to ETFs. MiFID II will provide more transparency around ETF trading, which will be helpful as many investors still have a relatively poor understanding of the trading and liquidity of ETFs. In 2017, about 70% of the trades in ETFs in Europe were done on an over-the-counter (OTC) basis as MIFID I did not make the reporting of ETF trades mandatory (see Fuhr, 2017). With the introduction of MIFID II in January 2018, investors are required

31 - https://www.justetf.com/en/how-to/euro-stoxx-50-etfs.html.
32 - ESMA Policy Orientations on Guidelines for UCITS exchange-traded funds and structured UCITS (2011).

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to report more information about their trades. Annualised projections based on first quarter 2018 data, suggest a shift from OTC to on-book trades, with as much as 61% of reported ETP trades projected to occur on-book/on-exchange, compared with only 39% OTC (see ETF.com, 2018).[33]

Indeed, the management fees charged by ETFs show that they come at low cost to investors. According to ETFGI (2018), the asset weighted average total expense ratio (TER) of European ETFs that offer exposure to a standard stock market index was 32 basis points, while the asset weighted TER of European ETFs that offer exposure to standard fixed-income indices was 26 basis points and the TER for commodity index ETFs was 44 basis points. According to ETFGI (2018), the most expensive products are alternative ETFs at 77bps. It should be noted that in spite of low average TERs, considerable differences exist across ETFs. There are 48 ETFs with an expense ratio below 10bps, while there are 43 ETFs with an expense ratio greater than 80bps. On the one hand, TERs differ depending on the indices that are tracked and are often higher for less standard indices. For example, iShares reports a TER of 7 basis points for an ETF on US large-cap stocks while it reports a TER of 68 basis points for an ETF on Emerging Markets small-cap stocks (Morningstar, 2017).[34] Moreover, pronounced differences exist across providers sometimes even for ETFs that track very similar indices. For example, the largest Europe-listed ETF to track the MSCI Europe Index has a TER of 35 basis points, while the cheapest fund tracking the MSCI Europe Index has a TER of 15 basis points.[35]

Despite strong growth since it came into existence, the ETF industry still only represents a fraction of the fund management industry: for the period from January 2012 to May 2017 the trading volume in ETFs on European exchanges ever exceeded 12% of the trading volume in cash equities in any given month over this period (Deutsche Bank, 2017). According to ETFGI, the European ETF market is currently the fastest-growing segment of the asset management industry, with a growth rate of around 15% in the year to date. However, by the late of 2017, the AUM in the European ETFs industry represent less than 7.5% of the overall fund management industry in Europe (see IPE, 2017).[36] A notable feature of the ETP industry is that it is highly concentrated. Concerning the global market, the top three players controlled over 71% of the AUM, and the top ten players over 85% of the AUM (Deutsche Bank, 2017). In Europe, there were 43 providers present in November 2017 and there is slightly less concentration at the very top, with the top three players controlling 65% of the AUM. The dynamics of the industry have remained fairly constant since last year in terms of the number of players.

In the context of the large growth of ETFs, a collection of recent papers question the influence of ETFs increasing ownership on the liquidity of the ETF component securities. These papers especially investigate the US market, where the market share dedicated to ETFs is even higher than in Europe. An interesting and quite complete review is to be found in Ben-David, Franzoni, and Moussawi (2017). It should be noted that there is a debate in this literature, as authors have provided evidence both of positive and negative effects of ETF trading on

33 - www.etf.com/sections/features-and-news/new-light-shines-europe-etf-trading?nopaging=1.
34 - See Garcia-Zarate (2017).
35 - See Revesz (2017).
36 - https://www.ipe.com/reports/special-reports/etfs-guide/how-to-crack-the-big-three-in-european-etfs/10021542.article.

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market liquidity and efficiency, and further research may be needed to explain the sometimes-divergent views. Israeli, Lee and Sridharan (2016) note that ETFs constitute about 30% of the daily value traded on US exchanges. Israeli, Lee and Sridharan (2016) evidence an increase of trading costs for those securities, associated with a decrease of liquidity. In the same way, Hamm (2014) reports an increase of illiquidity for those securities that are part of ETFs subject to increases of ownership. On the contrary, Glosten, Nallareddy, and Zou (2016) document an increase of information efficiency for securities that are part of ETFs experiencing higher trading, resulting from increased ownership. Israeli, Lee and Sridharan (2016) justify this difference in results by a different approach, as Glosten, Nallareddy, and Zou (2016) consider the current effect of increasing ownership on liquidity, while they test the effect in the future. Hamm (2014) explains this phenomenon by the fact that uninformed investors tend to depart from investment in individual stocks when they have the opportunity to invest in diversified ETFs or index funds – a result evidenced by greater illiquidity for stocks that are part of the more diversified ETFs. This economic consequence of the large development of index trading was already evoked by Wurgler (2011) and Broman (2016).

Ben-David, Franzoni, Moussawi (2015) argue that securities with higher ETF ownership exhibit higher volatility and are more likely to depart from the random walk. They notice that during turbulent market periods, arbitrage activity, which is necessary to reduce price discrepancy between ETFs and underlying securities, is limited. Consequently, ETF prices tend to diverge from those of the underlying securities.

However, Madhavan (2016) and Madhavan and Sobczyk (2016) have another point of view and detail that ETFs improve financial market information. According to them, ETFs will reflect new information before underlying securities, as long as arbitrage is frictionless. They are in line with Glosten, Nallareddy, and Zou (2016), who argue that stocks incorporate information more quickly as soon as they are part of ETFs. Their views are in accordance with Da and Shive (2016), who observe increasing comovements in returns of stocks that are included in an index, as well as with Wermers and Xue (2015), who report that ETFs enhance price discovery. Agarwal et al. (2016) document a correlation between the liquidity of ETFs and the liquidity of the security components of ETFs.

The growth of ETFs is explained by the fact that investors choose to replace investment in traditional index funds by investment in ETFs. Israeli, Lee and Sridharan (2016) relate that ETFs come more and more in replacement to traditional passive investment vehicles, such as index funds, closed-end-funds and index futures, as detailed in few recent studies. For example, Madhavan et al. (2014) argue that ETFs are a superior alternative compared to index futures, because of the mispricing that often occurs around the futures' rolling dates.

As ETFs combine the diversification of index funds and the trading ease and flexibility of stocks listed on exchanges, they should be analysed from both standpoints. Like traditional index funds, ETFs usually attempt to track or replicate a particular

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index of equities, debts or other securities. Like mutual funds, ETFs are registered as open-ended funds, continuously offering new fund shares to the public and required to buy back outstanding shares on request and at a price close to their NAV. Shares in ETFs can be traded on the market throughout the trading day, using the whole gamut of order types. Although the designs of ETFs and mutual funds are similar, investors can treat ETFs as normal stocks, buying or selling ETF shares through a broker or in a brokerage account, just as they would buy the shares of any publicly traded company.[37] ETFs give investors access to a wide array of asset classes and investment strategies. So, they are a type of investment vehicle and not an asset class in themselves.[38]

2.1.2. ETFs for Different Asset Classes

In this description, we will mention only ETFs that allow access to the normal returns of an asset class or segment of assets. When we say "normal returns" we mean those that represent the reward for exposure to systemic risk factors. We do not mention ETFs that are actively managed or use structured forms of investment strategies – for instance, those offering exposure to specific payoff profiles through the use of derivatives, such as buy-write ETFs.[39] We describe the asset classes now covered by ETFs. In addition to the standard equity and fixed-income ETFs, we mention ETFs on a range of alternative asset classes.

Equity ETFs

ETFs that replicate stock market indices were the first on the market and are still the most important type.[40] Broad market ETFs attempt to replicate the returns of the entire stock market as reflected by a broad index such as the S&P 500 for the US or the Stoxx 600 for Europe. Such broad ETFs offer diversified exposure to general equity markets. They are thus a shortcut for investors seeking to hold a part of the market (Stock, 2006).

The aim of style ETFs is to replicate the returns on a particular investment style. In equity markets, firm size (large-cap, small-cap) and investment style (growth, value) have been shown by Fama and French (1992) to be important determinants for the cross-sectional variation in expected stock returns. Style ETFs build on these findings and replicate the returns of such investment strategies. Sector ETFs focus on industry sectors, which they attempt to replicate. The motivation for relying on sector exposure to construct an equity portfolio is provided in a study by Ibbotson Associates (2002) that highlights the low correlation of different sectors and the low correlation of sectors and the market. Another study (Hamelink, Harasty and Hillion, 2001) shows that the benefits of sector diversification outweigh those of country diversification. Further evidence of the importance of sector and style diversification is provided by Vardharaj and Fabozzi (2007). Finally, ETF providers have moved from providing exposure to mature markets to providing exposure to emerging market equity, either in the form of global emerging market indices or in the form of specific country exposures.

Fixed-income ETFs

In addition to equity markets, ETFs may provide exposure to fixed-income markets. These ETFs can, of course, provide exposure to broad market indices as well as to more specific segments. Maturity-segment ETFs reflect the returns on investments in debt with terms to maturity ranging from short to long. Inflation-protected bond ETFs invest only in inflation-protected bonds.

37 - Sometimes ETFs are wrongly classified as closed-end funds, since both exhibit similar features, such as holding multiple securities and asset classes. Furthermore, both can be traded on exchanges. The most important difference from closed-end funds is that ETFs always trade very closely to their NAV, since any deviation can be exploited by arbitrageurs redeeming and then buying new units. Closed-end funds, by contrast, rarely trade at their NAV.

38 - For more detailed information on ETFs, one can refer to the previous editions of the survey. In the present document, which leaves a larger part to smart beta and factor investing, we have chosen to restrict the ETF background section content to the only information that serves for the ETF section of the questionnaire.

39 - http://finance.yahoo.com/news/buywrite-etf-hits-market-130014274.html.

40 - Actively managed ETFs are meant, like mutual funds, to deliver above-average returns. They charge more than traditional ETFs but, in general, less than mutual funds. They are supposed to have some of the advantages of ETFs, such as transparency, tax efficiency, and liquidity, all while being actively managed. However, since managers are paid for their stock selection, frequent disclosure of the underlying stock holdings would encourage investors to buy the underlying securities on their own instead of trading ETFs. On the other hand, if transparency is low, the price of ETFs would suffer significant deviation from the NAV of the underlying holdings.

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Due to the recent sovereign debt crisis, the choice of countries included in government bond indices has been the subject of some discussion. Drenovak, Uroševic and Jelic (2010) have shown that differences in countries included have resulted in pronounced differences in performance. Some providers dissected the universe into high rated issuers and low rated issuers so that they could offer investors a clear picture. Also, one could see that emerging market sovereign bonds seem to be perceived more favourably compared to developed market bonds since investors consider the often lower debt-to-GDP ratio in emerging markets compared to developed countries (Yousuf, 2011; McCall, 2011). Following this trend, many ETF providers have started to launch local currency emerging market bond ETFs.[41]

ETFs not only track government bond indices but also broad corporate bond indices. In addition, a few sub-segment corporate bond ETFs are available to investors, for instance, financials vs. ex-financials, investment grade vs. high-yield, and short-term vs. all maturities.

Credit Default Swap (CDS) ETFs are another way to access to the corporate credit market other than corporate bond ETFs. CDS ETFs represent the performance for continuously investing in CDS as a protection seller/buyer. Unlike corporate bond ETFs, CDS ETFs are less sensitive to interest rate changes as the interest rates embedded are the overnight rates which lead to a close to zero duration (Deutsche Bank, 2010).

Money Market ETFs

There are also ETFs designed to replicate the returns of short-term cash instruments. These funds offer investors a way to invest in various cash-like short-term securities, including commercial paper, repurchase agreements, Treasury bills, and certificates of deposit. These funds have drawn investor attention for the interest rates they pay, usually higher than those of certificates of deposit, and for their TERs, lower than those of money market mutual funds (Johnson, 2010). Moreover, money market ETFs usually provide a degree of diversification not easily achieved by individual investors and are seen as safer than bank deposits (Amery, 2008).

Currency ETFs

Currency ETFs invest in a single currency or basket of currencies. There are two main investment strategies for currency ETFs. In the first, passive tracking, movements in a particular currency or a basket of currencies are replicated. In the second, systematic currency trading, long/short positions in various currencies are taken. Examples of currency trading strategies are the carry trade and the momentum strategy. The carry trade consists simply of borrowing the low-yield currency and buying the high-yield currency. The academic literature has identified the carry trade as a source of a risk premium similar to the risk premia for value or small-cap stocks.[42] The momentum strategy reflects the view that currencies will continue performing as they have been. Taking long positions in the currencies with the highest returns, short positions in the currencies with the lowest returns, or both positions, will lead to returns higher than those of a buy-and-hold strategy. Currency ETFs have attracted investors as they can be used for hedging or diversification (Jagerson, 2007).

41 - Amundi ETF has its Global Bond Emerging Market iBoxx in 2010. iShares launched local currency emerging market debt ETFs in June 2011. There are also Market Vectors Emerging Market Local Currency Bond ETF and WisdomTree Emerging Market Local Debt ETFs listed in the US.

42 - See Brunnermeier, Nagel and Pedersen (2008) or Jurek (2007) for an analysis of these strategies.

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Volatility ETFs

Volatility ETFs are products which intend to mimic the performance of a volatility index through rolling the index future/forward contracts. The volatility index was first introduced to the equity markets in 1993 (Whaley, 2008), and has since become a hotspot among investors. A key point to note is that volatility of equity returns tends to move in opposite directions (i.e. they are strongly negatively correlated). So, taking a long position on volatility could diversify equity risk (Hill and Rattray, 2004; Szado, 2009). In addition, negative correlation and high volatility are particularly pronounced in stock market downturns, offering protection against stock market losses when it is needed the most and when other forms of diversification are not very effective (Jacob and Rasiel, 2009).

Unlike volatility-linked ETNs – which are unsecure, unsubordinated debt securities (see Goltz and Stoyanov, 2012) – volatility ETFs are funds. In Europe, they follow UCITS regulation. So, there is less credit risk exposure.

Alternative Asset Class ETFs

The concept of ETFs has been extended to alternative investments. These investment products enable investors to gain simple access to alternative investment opportunities such as hedge funds, commodities, real estate or infrastructure. ETFs on alternative asset classes allow investors to diversify portfolios but do not require the infrastructure needed for direct investments and manager selection in alternative asset classes, infrastructure they may be unfamiliar with. The benefits of using alternative index ETFs in a global portfolio have been analysed by Pezier (2008).

ETFs in the alternative investment universe must deal with illiquid underlying assets, an obligation at odds with one of the main objectives of ETFs, that is, to provide high liquidity. As a result, ETFs must usually rely on liquid proxies of the asset class that can only approximate the price movements in these asset classes.

Hedge fund ETFs, for example, can rely on hedge fund factor models that make it possible to replicate the performance of broad hedge fund indices by investing in more standard and thus more liquid assets. Hedge fund ETFs can also be set up with the help of managed account platforms: these ETFs enable investors to invest directly in hedge funds via so-called parallel managed accounts of hedge fund managers. To ensure the liquidity of the ETFs, only hedge fund managers who are active in strategies known for their liquidity are selected. Commodity ETFs are based mostly on commodity futures, although some funds also invest directly in such precious metals as gold. Illiquid underlying holdings are also a problem for real estate ETFs. Real estate ETFs usually replicate real estate indices that are based on real estate investment trusts (REITs), listed collective equity investment vehicles that provide relatively high liquidity. They may also invest in a basket of real estate stocks. Infrastructure ETFs invest in stocks or indices from three clusters: energy, transportation, and utilities (see Fuhr and Kelly, 2009).

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2.1.3. Alternatives to ETFs: Other Index-Tracking Vehicles

In addition to ETFs, there is a variety of financial products that allow simple trades of large baskets of assets: traditional index funds, futures, and total return swaps (TRS). Because of their similar features, they can be regarded – depending on the investment purpose – as alternatives to ETFs.

The closest of these alternatives are traditional index funds, which are in fact the predecessors of ETFs. Index funds can be viewed as unlisted ETFs, to which they are very similar, except that they can be bought from and sold only to the managing company of the mutual fund (primary market). As ETFs are growing rapidly, the academic literature has addressed the question of whether ETFs are replacing index funds. Agapova (2011) finds that the asset inflows to ETFs do not reflect asset outflows from conventional index funds. Blitz, Huij and Swinkels (2012) find little difference in terms of benchmark relative performance between European index funds and ETFs. However, Guedj and Huang (2008) show that ETFs can be substitutes for index funds that track large, broad, well-diversified and liquid indices because both of them offer investors a fairly identical investment vehicle. Overall, there is no clear consensus in the literature as to whether the growth of ETFs is coming at the expense of index funds, and there is relatively little recent evidence that accounts for current investor perceptions.

2.1.4. Benefits and Uses of ETFs

Given that they are hybrids of stocks and funds, ETFs provide institutional and private investors with a number of combined benefits and, as a result, improve the ways they invest. ETFs are much easier to trade than funds. Moreover, a single ETF trade can provide much broader exposure than a single stock trade. They are also tax efficient.

Ease of Trading

The ease of trading ETFs is the result of their liquidity and transparency. The advantage of highly liquid markets such as the ETF market is that large amounts of assets can be traded without making a large impact on the market. The liquidity of ETFs stems from their listing on-exchange and from direct provision of ETFs by authorised participants. Investors can enter or exit at any time. Small trades can be executed whenever the exchange is open and at market prices that change from moment to moment, which shows a higher degree of liquidity than traditional index funds, priced once a day at the close. Any type of order used in trading stocks can be used in trading ETFs. For larger trades, ETF shares can be handled efficiently by authorised participants under the in-kind creation and redemption process.

Transparency

ETFs are considered more transparent than mutual funds. The detailed composition of the fund is published on a daily basis, and the NAV is frequently computed and made available to the market during trading hours. Investors are able to see what exactly goes into the ETF, and the investment fees are clearly laid out. In the light of pricing scandals that have affected the mutual fund industry, the transparency of ETFs has become quite a draw; indeed, at the outset, it served as an impetus for the growth of the market.

Cost

One of the primary advantages of ETFs is that they offer all of the benefits associated

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with index funds at much lower cost. Because of the essence of index-tracking, ETFs obviously charge less than actively-managed funds. Moreover, even though, like stocks, they involve commissions, their lower costs may make them more attractive than traditional index funds. It is useful to distinguish two aspects of costs, TERs and transaction costs.

Firstly, ETFs charge management fees and other operating fees. The TER offers a fair standard by which to compare such costs, since management fees alone might lead to misconceptions.

Secondly, ETF shares must be bought by investors, either on- or off-exchange, and the investor incurs transaction costs. If ETF shares are bought or sold on-exchange or OTC, the investor incurs transaction costs that amount to brokerage fees, as well as half the bid/ask spread. If ETFs are bought at an unknown NAV, the investor does not bear costs in form of bid/ask spreads, but in the form of creation/redemption costs.

Costs differ significantly from one ETF to another. Differences are found in both TERs and transaction costs (either bid/ask spreads or creation/redemption fees). These differences are not merely a result of the different index or asset class tracked by the ETF; indeed, the costs of ETFs that track similar segments or even the same index may differ.

The cost advantage of ETFs over other indexing instruments obviously depends on the benchmark. For large institutional investors, mandates to replicate an index are usually less costly but also less liquid than an ETF. But ETFs usually charge less than other open-ended index funds. Moreover, the costs are specific to the context in which the index products are used. In particular, the position size and frequency of trading determine the relative merits of each instrument. Kostovetsky (2003), for example, finds that for large investments ETFs are preferable to index funds, while for small amounts, the high transaction costs make ETFs less attractive unless the holding period is long. Gastineau (2001) notes the reasons that make ETFs more cost efficient than index funds. First, ETFs are usually very large funds, allowing economies of scale and, second, expenses for the transfer agency function of mutual funds are not incurred with ETFs.

Obtaining Broad And Diversified Market Exposure

ETFs allow investors to gain instant and diversified access to various markets. Once an investor buys an ETF, he gets exposure to the entire market for the underlying assets and diversification of systematic risk. Moran (2003) has argued that ETFs are a useful means of achieving diversification. In addition, the portfolio of ETFs can provide more customised diversification. A cautious investor who wants to invest in real estate and fixed-income, for example, could easily form a portfolio by trading ETFs that track real estate indices and fixed-income ETFs, and he could structure the fixed-income portion by splitting it into medium-term and short-term bonds or government bonds and corporate bonds. Miffre (2006) has shown that the ability to construct portfolios of country-specific ETFs makes it possible for the equity investor to obtain risk-adjusted performance better than that obtained by holding a global index fund.

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Trading With High Tax Efficiency

Tax-conscious investors have lately begun to prefer ETFs to mutual funds. The special tax rules on conventional mutual funds require that realised capital gains be passed to shareholders, a requirement that is widely regarded as increasing the tax burden on buy-and-hold investors (Dickson and Shoven, 1995; Dickson, Shoven and Sialm, 2000). Although ETFs are subject to the same tax rules as mutual funds, their distinct "redemption in-kind" mechanism, allowing an investor to redeem a large number of ETF shares by swapping ETFs for the underlying stock, does not incur capital gains. Poterba and Shoven (2002) compared the before- and after-tax returns of SPDR (an ETF that holds the securities in the S&P 500) and the Vanguard Index 500 fund from 1994 to 2000 and they find that tax effects are favourable for the ETF. Some investors even use ETFs for such tax manoeuvring as realising capital losses and getting around restrictions on wash-sales (Bansal and Somani, 2002).[43] The tax efficiency of ETFs is also described by Bouchey, Brunel and Li (2016) in a context of active tax management.

43 - A wash-sale is the sale of a security at a loss followed by the immediate repurchase of the identical security. Wash-sales are used to reduce the tax burden, since other capital gains can often be offset by these capital losses and thereby reduce total taxable gains.

2.1.5. Tracking Error and Liquidity

Tracking error and liquidity are the two most crucial criteria for evaluating the quality of an ETF. So it is important to know how to assess them.

Tracking Error

There are many ways to assess the tracking quality of an ETF. First, and quite evidently, it is possible to analyse the difference between the returns on the ETF and those on the index. Second, the correlation of the two assets can be used to determine the tracking quality. Another simple method of analysing tracking error is to compare the mean returns of both assets. There are, however, more sophisticated means of evaluating tracking error. These means include asymmetric or downside tracking error (which is the relative return equivalent to downside risk measures such as semi-variance in an absolute-return context), co-integration analysis (see Engle and Sarkar (2006) for an application to the tracking quality of ETFs) or Bayesian analysis (see Rossi (2012) for an explanation of their approach which decomposes tracking error into temporary and permanent components).

Tracking Error Across Different Types Of Indices

The number of ETFs has been growing steadily over the past decade. Though the purpose of an ETF is to track the underlying index, not all ETFs could achieve this objective with the highest accuracy. There are a number of studies dedicated to investigating the differences in tracking error across various types of indices.
Rompotis (2011) studies three active ETFs and three corresponding passive ETFs in the US and finds that the active ETFs have higher discrepancy than their passive counterparts in terms of index returns. This is easily explained by the fact that the purpose of active ETFs is not to track the index, but rather to beat it. It is expected that active ETFs would have higher tracking error. ETFs built on strategies such as leveraged ETFs and inverse ETFs also experience higher deviations compared to the traditional ETFs (Rompotis, 2010a).

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Other than the difference between active and passive ETFs, liquidity may also affect the tracking error. Ackert and Tian (2000) finds that MidCap SPDRs trade at a large discount, whereas the price of Large-Cap SPDRs does not differ significantly from their NAV. Rompotis (2008, 2010b) also shows that the tracking error is positively affected by the bid-ask spread, which is the commonly used indicator for liquidity. Vardharaj, Fabozzi and Jones (2004) find that the tracking error tends to increase when the volatility of the benchmark increases.

Rompotis (2009) also finds that ETFs that track international indices have higher tracking error than those tracking local country indices. This difference in tracking error comes from the expense ratio and the volatility of the ETFs. Jares and Lavin (2004) analyse ETFs traded in the US market but that have significant exposure to the Asian markets and find that the less overlapping hours there are between foreign stock exchanges and the US exchanges, the more the tracking error there is. A similar conclusion was reached by Johnson (2009), who analysed 20 foreign country ETFs which tracked the S&P 500. In addition, Maister et al. (2010) show that ETFs that track emerging market indices exhibit higher tracking error than those that track indices in other market segments. They conclude that the major source of this increase in the ETF tracking error relates to the SEC diversification requirements, as some of the indices have overweighted certain companies beyond the limits set by the SEC. This means that regulation prevents funds from matching the actual index weights.

Unlike the previous studies, which mainly focus on equity ETFs, Drenovak, Uroševic and Jelic (2010) investigate the driving factors for sovereign ETFs that track error. They showed that the fixed-income tracking error is affected by the maturity, and the average CDS spread of the constituents. Bond ETFs with longer maturities as well as widening CDS spreads would tend to have more volatile tracking error.

ETF Tracking Quality

The tracking quality of ETFs may be characterised by several indicators, including not only the tracking error but also the tracking difference. The tracking difference is the difference between ETF total return and the total return of the replicated index, while the tracking error evaluates the volatility of the difference in return between an ETF and its benchmark.

Bonelli (2015) shows that depending on whether we consider the level of tracking error or the level of tracking difference, the ranking of ETFs that track the same index may greatly differ. For example, he observes that tracking error varies significantly across the different ETFs that all track the MSCI World Index (from 0.02% to 0.22%). The ETF with the lowest tracking error relative to the index has one of the highest tracking differences (-0.42%), and thus greatly underperforms its benchmark, while an ETF which has one of the highest tracking errors (0.21%) is also the one with the lowest tracking difference (-0.19%).

Similar results were obtained for two other indices, namely the MSCI Emerging Markets Index and the MSCI Europe Euro Index. Bonelli (2015) concludes that tracking error

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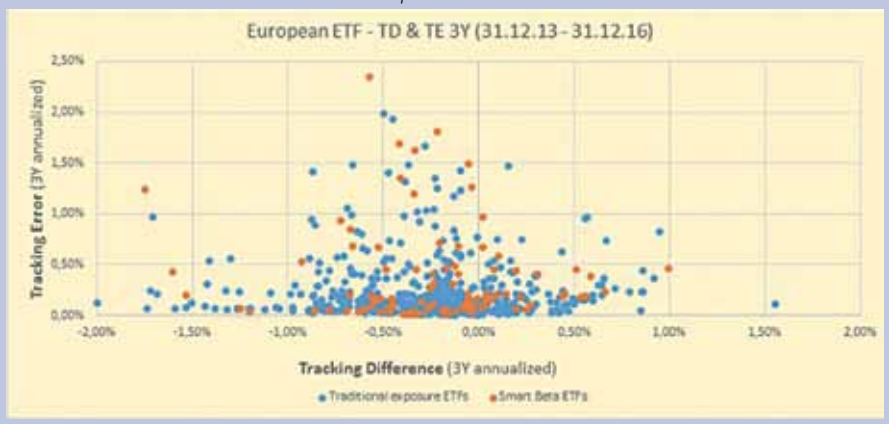
is not representative of the under- or outperformance of ETFs with respect to their benchmark, but serves first of all to evaluate the relative risk of daily deviations and is of more concern for short-term, rather than for mid-term or long-term, investors. Long-term investors may be more interested by measuring the tracking difference, as its level provides a more relevant indication of costs of ownership than does the expense ratio. Indeed, if ETF replication were perfect, the tracking difference would be equal to the ETF expense ratio.

It is a common belief that ETFs that track 'smart beta' indices (non-market-cap-weighting schemes and/or factor exposure) exhibit weak replication quality due to friction costs implied by the possibility of more frequent and wide index rebalancing. Exhibit 2.1 is an illustrative analysis of the performance of smart beta vs. traditional exposure ETFs vis-à-vis their respective benchmarks. It shed lights on replication accuracy with no consideration of the risk/return profile of the associated benchmarks. The analysis covers a universe of 732 Europe-domiciled ETFs that exhibit a three-year track record (Jan 2014 – Dec 2016) that can be analysed on www.trackinsight.com.

Exhibit 2.1: Performance of Smart Beta vs. Traditional Exposure ETFs



Source: www.trackinsight.com

The analysis tends to demonstrate there is NO evidence that Smart Beta ETFs would possibly exhibit poor performance relative to their benchmarks that are tracking non-market-cap-weighting schemes.

Average Tracking Difference is strictly the same on the two universes, medians are close and dispersion around the mean is comparable. This analysis tends to contradict the common belief that smart beta benchmarks imply higher replication frictions due to more frequent or sizeable rebalancing.

Exhibit 2.2: Detailed Statistics on Tracking Difference and Tracking Error Measures

		3Y TD			3Y TE		
	# ETFs	Mean	Median	Standard deviation	Mean	Median	Standard deviation
Traditional Exposure	637	-0.24%	-0.18%	0.414%	0.20%	0.10%	0.28%
Smart Beta	95	-0.24%	-0.21%	0.461%	0.36%	0.17%	0.46%

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However, when it comes to the tracking error, we can observe a higher level of daily volatility for smart beta ETF-relative returns, which can be explained by the need to rebalance the portfolios outside the rebalancing windows for market-cap ETFs. On the other hand, this could also possibly be explained by a bias towards less liquid securities for some smart beta strategies, resulting in higher volatility in execution costs, with no significant impact on net costs in the long run.

Liquidity

The second key issue with indexing instruments is liquidity. Practitioners, of course, are highly familiar with liquidity, but the finance literature has yet to come to a consensus on theory and on empirical methodology. Practitioners, for example, have long used a number of liquidity measures, but academic articles continue to debate their merits. Popular liquidity indicators are market spreads, turnover, and AUM. Several authors in the finance literature have proposed more advanced liquidity measures, as proposed by Amihud (2002) and Acharya and Pedersen (2005).

Of course, the number of transactions in ETF shares is not necessarily indicative of the liquidity of an ETF. For several reasons, in fact, ETFs may be classified as highly liquid even if relatively few ETF shares change hands. The first is that the market maker has a contractual obligation towards the stock exchange and towards the ETF provider to fulfil its role as market maker for a given transaction size and with a determined maximum spread. Therefore, even if trading volume is low on a given day, ETF investors can trade at any time of the day. The second reason is that in Europe most ETF transaction volume actually takes place off-exchange, either by trading ETF shares OTC or at unknown NAV. The volume traded on-exchange is thus not a reliable indicator of the actual transaction volume.

The true liquidity of an ETF is the liquidity of the underlying securities. After all, any deviation of the price of the ETF from the price of the basket of securities is easily arbitraged away through the creation and redemption mechanism. This arbitrage depends only on the liquidity of the underlying securities. As described above, the market maker swaps ETF units with the ETF custodian for the basket of securities of the ETF, so it is the liquidity of securities in this basket that matters.

The bid-ask spread is a common indicator of an asset's liquidity. It has been documented in detail how the bid-ask spread of an ETF can be broken down into its components (see Amundi ETF, 2011). Since market makers have to make a hedge when they trade ETFs with clients, one part of the ETF spread is reserved for them to buy/sell the underlying. Usually, the ETF bid-ask spread comprises five components: the spread of the underlying, taxes, exchange costs, the carry cost of the ETF as well as the margin of the market maker. In this case, the spread of the ETF will often be affected by the location of the underlying market, the number of constituents, the trading hours and the size of the order.

Calamia, Deville and Riva (2013) provide extensive empirical evidence on the drivers of bid-ask spreads. Their results suggest that the size of an ETF (in terms of AUM or volume traded), the replication method, and market

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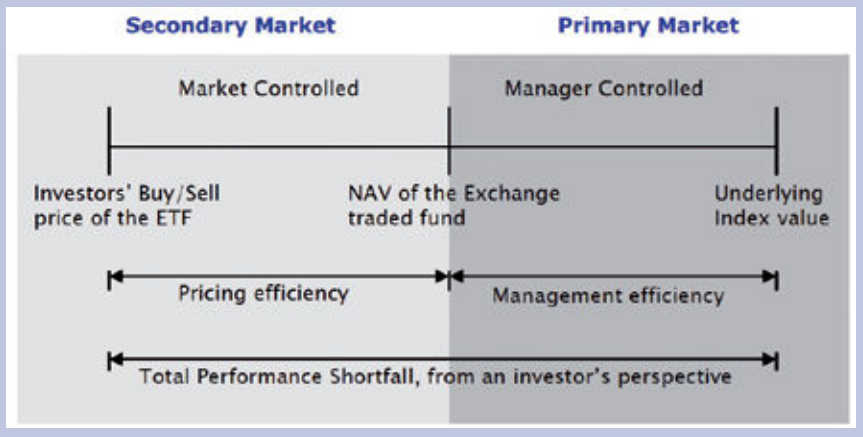
fragmentation influence the bid-ask spread (also see Stoll (2000), Rompotis (2010b), or Agrrawal and Clark (2009) for analyses of determinants of bid-ask spreads). Thirumalai (2004) shows that there is a positive relationship between the bid-ask spread and volatility – securities which are more volatile tend to have larger spreads. Furthermore, Rompotis (2008, 2010b) demonstrates that the bid-ask spread is positively related to the absolute value of the premium (the difference between the price and the NAV) as well as the tracking error. According to these empirical results, higher bid-ask spreads tend to occur together with higher volatility and tracking error.

Pricing and Performance Drift

Although index ETFs are designed to track an index passively and provide exposure to its risk and performance features, ETFs that for legal reasons cannot fully replicate an index need to be managed more actively. Any deviation of an ETF's returns from the underlying index returns results in a performance gap. Unlike index funds, which can be bought and sold only at their daily NAV, ETFs can be exchanged in secondary markets at ask/bid prices that may differ from their NAV. Exhibit 2.3 provides a description of the sources of deviation that ETFs may encounter.

Exhibit 2.3: Performance Shortfall of an ETF



For an investor, the total performance shortfall (or gain) is the right measure with which to identify the gap between the performance of the ETF and that of its underlying index. This gap should be measured as the return difference between the underlying index and the ETF – taking into account the investor's actual buying price. This price, however, is not easy to obtain, and might require studying specific transactions to take into consideration the specific market impact of such trades.

The total performance shortfall can be conceived as the sum of the ETF management inefficiencies and market inefficiencies. Since the former lie within the ETF management itself, they can be controlled by the fund management company. Given that they depend on the market makers, supply and demand, and transaction costs, the latter are beyond the control of the ETF company.

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Net Asset Value versus Market Price

An ETF has an NAV calculated with reference to the market value of the securities held. NAV is the total value of the fund after netting the market value of each underlying share in its holdings, cash, accruals, fees, operating costs and other liabilities and divided by the number of issued shares. For fully replicated index trackers, the NAV should be exactly the same as or very close to the fund's underlying index value (this is not true for index-tracking leveraged ETFs which offer a multiple of the return on the underlying index.) On-exchange, however, the market price of an ETF, like that of a stock, is determined by supply and demand. ETFs are bought and sold at their market prices, which may be at a premium or discount to their NAVs. When the market price of an ETF is not equal to its NAV, arbitrage opportunities are created and the creation and redemption process brings the fund's market price back to its NAV.

The intraday NAVs of ETFs are also usually calculated every fifteen seconds by third-party vendors; the market prices of the underlying index constituents are taken into account so that investors can tell whether the ETF is fairly priced. This intraday NAV, also known as indicative net asset value (iNAV) or indicative optimised portfolio value (IOPV), is different from the daily NAV of the fund, which is computed after the market closes for the day.

In empirical studies, Marshall, Nguyen and Visaltanachoti (2012) show that ETF mispricing occurs reasonably frequently. Usually, such mispricing is small, but leveraged/inverse ETFs show greater mispricing. Marshall, Nguyen and Visaltanachoti (2012) find the mispricing due to a decrease in ETF liquidity. Petajisto (2011) finds that this mispricing is greatest for ETFs holding international or illiquid securities, which corresponds to the fact that increased transactions costs for illiquid underlying securities will deter arbitrage at smaller levels of ETF premia.

Dolvin (2010) shows that price deviation can lead to arbitrage opportunities. Shum (2010) analyses the international ETFs and shows that Asian ETFs are trading at a premium/discount compared to their underlying indices in the US as ETFs could anticipate the market reaction to the movement of the US market due to the time difference. However, Engle and Sarkar (2006) find that in the US ETFs have highly efficient prices, though their conclusions for international ETFs are different. In fact, the authors find that the premia or discounts on fund NAVs are usually small and disappear very quickly, a disappearance that confirms the view that the creation and redemption mechanism of ETFs effectively limits and destroys arbitrage opportunities.

Performance Drift

Ideally, ETFs should derive their value and volatility only from the market movements of the underlying index or market prices of the constituent securities of this index. But perfect replication is not always possible; in fact, performance drift is inevitable. An index portfolio is only a paper portfolio and requires virtually no management, administration, asset buying or selling, custody, and so on. An ETF, by contrast, holds assets physically, manages them, distributes dividends and handles a relationship with investors. These operations incur costs. So to keep costs down and make sure they are

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consistent it is necessary to understand the components of these costs. Several costs can be a drag on ETF performance, some related to the direct costs of implementing the strategy, others to the way the index is replicated and exceptions handled:

- Implementation: ETFs need not replicate indices by buying or selling the underlying securities. They are paper portfolios calculated on the basis of market prices and weightings of their underlying securities. The underlying securities may not be very liquid and, given the large size of an ETF portfolio, the price of a constituent security may go up as a result of high demand during implementation. This cost, also known as portfolio construction/rebalancing cost or transition cost, which also includes the actual transaction costs, results in a performance drag on the ETF portfolio.
- Management fees and other operational expenses: unlike ETF portfolios, indices do not incur management fees, administrative costs and other operating expenses. Often expressed in terms of TER as a percentage of the NAV, these costs are deducted from the ETF assets and the daily NAV is affected accordingly (daily accrual). When dividends and interest income are paid, usually every quarter or twice a year, total management expenses are deducted from the payment and the NAV of the ETF returns to the index value.
- Transaction costs in the secondary market: investors buying or selling ETFs on-exchange through their broker must shoulder brokerage commissions, bid/ask spreads, the market impact of a large transaction, stamp duty, transaction levies charged by the exchange, and so on. These costs make ETF returns lower than those of the underlying index.
- Cash drag: if ETFs pay dividends they usually do so every quarter or twice a year. However, the underlying securities pay dividends sporadically throughout the year. While the index value reflects full dividend reinvestment, an ETF portfolio holds extra cash that has no capital appreciation, no returns. This generates a minor disparity between the ETF portfolio value and the underlying index value. Tracking error caused by this phenomenon is called "cash drag" because the ETF portfolio holds extra cash that drags its performance down.
- Mispricing costs in secondary markets: an ETF may trade at lower than (discount) its NAV or higher than (premium) its NAV. Factors such as unmatched supply and demand, illiquid underlying securities, and market inefficiency may contribute to the move of trading prices away from NAV. Since ETF shares can be created or redeemed anytime during trading hours by authorised market participants or arbitrageurs, this disparity does not last long.

On the other hand, there are also several ways that ETF managers can offset some of the replication costs. In some cases an ETF can yield higher returns than the index to be replicated through the following:

- Securities lending: ETF providers can lend their securities to other market participants and thereby earn lending fees.
- Tax benefits: in some countries it is possible to partly recover withholding taxes through the purchase of single stocks during the period of dividend payments. Blitz, Huij and Swinkels (2012) show that a large proportion of the underperformance not

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accounted for by the TER is due to dividend taxes.

• Management of index events: intelligent management of index component changes and other events can generate additional returns for the ETF. However, if done unsuccessfully, such management may also lead to underperformance of the index.

2.2. Smart Beta and Factor Investing Strategies

Recently, the standard practice of using a capitalisation-weighting scheme for the construction of indices has been the target of harsh criticism. Nowadays, growing demand for indices as investment vehicles has led to innovations including new weighting schemes and alternative definitions of sub-segments. There are also many recent initiatives for non-cap-weighted ETFs. Since the first fundamental factor-weighted ETF launched in May 2000 (Fuhr and Kelly, 2011), there have been quite a number of ETFs introduced to track non-market-cap-weighted indices,[44] including equal-weighted ETFs, minimum variance ETFs, characteristics-weighted ETFs, etc.[45] These have been coined "Smart Beta ETFs" as they seek to generate superior risk-adjusted returns compared to standard market-capitalisation-based indices. AUM in strategic-beta ETFs quadrupled over the last four years (Morningstar, 2017).[46] According to ETFGI, at the end of September 2017, there were globally 1,284 smart beta equity ETFs and ETPs and 161 providers of such funds, listed on 40 exchanges in 33 countries. At the end of December 2017, there were globally US$658.35 invested in smart beta ETFs and ETPs, representing an increase of 32.3% compared to the end of 2016. However, during the same time the increase for assets invested in market-cap ETFs was of 40.3% (ETFGI, 2018). According to Lyxor (2018), the AUM of European smart beta ETFs reached €35.2bn at the end of 2017, representing an increase of 22% compared to the end of 2016, and accounting for 4% of total asset increase.

44 - For instance, PowerShares adopted a fundamental index methodology and launched PowerShares FTSE RAFI ETFs that cover both the US and global markets since 2005. Wisdom Tree introduced a series of ETFs weighted by different fundamental factors, such as dividends and earnings since 2006. RevenueShares launches some revenue-weighted ETFs in 2008.

45 - Rydex introduced the first equal-weighted ETF in 2003. It tracks the S&P Equal Weight Index. iShares and Ossiam also launched equal-weighted ETFs in 2011. In May 2011, PowerShares launched the first beta and the first volatility weighted ETFs.

46 - See Garcia-Zarate (2017).

47 - Text prepared with the contribution of Noël Amenc.

48 - For example, consider the following quotes from marketing material of index providers: "MSCI currently identifies six equity risk premia factors... They are grounded in academic research..."; "In developing the Russell High Efficiency Factor Index series...we ensured that all of our factor specifications were consistent with academic research findings," "The FTSE Global Factor Index Series is...designed to represent...factor characteristics for which there is a broad academic consensus"; ERI Scientific Beta: "factor indices are meant to be investable proxies for rewarded factors that have been analysed in the academic literature."

Long-Term Rewarded Equity Factors: What Can Investors Learn from Academic Research? [47]

The Venerable "Academic Grounding"

Equity index products that claim to provide exposure to factors that have been well documented in academic research, such as value and momentum, among others, have been proliferating in recent years. Interestingly, providers across the board put strong emphasis on the academic grounding of their factor indices.[48] It therefore appears useful to analyse what academic research has to say on equity factors in order to understand what we can learn from such research on designing or evaluating factor indices. When analysing academic publications on equity factor investing, three important lessons emerge, which are addressed in the sections below.

Lesson One: "Be Serious With Data"

When establishing which factors carry a reward by way of empirical analysis, it is important to understand that this is a rather daunting task. In fact, since the paper

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by Merton (1980), it has become well-known that researchers struggle to estimate expected returns reliably, simply because there are very few data points that can be relied on to estimate long-term expected returns: the starting price level and the end date price level. Of course, this is also true for factor returns.

Given this difficulty, when testing whether a factor carries a positive premium, academic research conducts a thorough assessment, including the analysis of very long-term data (covering time spans of at least 40 years), analysis across different regions and asset classes, and various corrections for possible data-mining biases. Importantly, these studies are open to criticism. Numerous papers are written to question previous empirical results (see for example the debate on the "low volatility puzzle"). For these reasons, academic research is much more capable of providing meaningful conclusions than a product back-test for a given factor index product. Even if a back-test is conducted very thoroughly by a product provider, it is hard to believe that the provider is able to conduct as thorough an analysis of the whole academic community, whose members have strong incentives not only to publish their own results but also to challenge the results of others by way of replicated tests. Therefore, factors which have undergone academic "validation" constitute a much stronger empirical justification than a mere product back-test.

The first important characteristic of empirical evidence on factor premia, as mentioned above, is that this evidence is derived based on tests applied to long-term data. In fact, studies on US equity data typically span at least 40 years of data, and in many cases, data goes as far back as the 1920s. For illustrative purposes, Exhibit 2.4 provides an overview of results obtained on key factors with long-term US data.

Exhibit 2.4: US Evidence on Equity Factor Premia

Factor	Factor Definition	Period	Premium	t-stat	Source
Market	Excess returns of cap-weighted equity index	1926-2008	7.72% (annual)	3.47	Ang et al. (2009)
Size	Stocks with low vs. high market cap	1926-2008	2.28% (annual)	1.62	Ang et al. (2009)
Value	Stocks with high vs. low book-to-market	1926-2008	6.87% (annual)	3.27	Ang et al. (2009)
Momentum	Stocks with high vs. low returns over past 12 months (omitting last month)	1926-2008	9.34% (annual)	5.71	Ang et al. (2009)
Low Risk	Stocks with low vs. high risk (beta, volatility or idiosyncratic volatility)	1926-2012	0.70% (monthly)	7.12	Frazzini-Pedersen (2014)
Profitability	Stocks with high vs. low profitability (e.g. return on equity or gross profitability)	1963-2013	0.17% (monthly)	2.79	Fama-French (2014)
Investment	Stocks low vs. high investment (change in total assets)	1963-2013	0.22% (monthly)	3.72	Fama-French (2014)

A second important characteristic of empirical research on factor premia is the assessment across different regions and asset classes. In fact, merely deriving a result from US data, even if it holds in long-term data, does not allow the findings to be generalised to other geographic or investment contexts. From the standpoint

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of generalisation, it is therefore interesting if results can be confirmed on equity markets for other geographies or even in entirely different asset classes. Research has made considerable progress in this direction over the past decade, with surprisingly strong confirmation of the US equity results in other investment universes.

Exhibit 2.5: Empirical Evidence for Selected Factor Premia

	US Equities	International Equities	FCC
Size	Banz (1981); Fama and French (1993)	Heston, Rouwenhorst and Wessels (1999); Fama and French (2012)	N.A.
Value	Basu (1977); Rosenberg, Reid and Lahnstein (1985); Fama and French (1993)	Fama and French (2012)	Asness, Moskowitz and Pedersen (2013)
Momentum	Jegadeesh and Titman (1993); Carhart (1997)	Rouwenhorst (1998)	Asness, Moskowitz and Pedersen (2013)
Low Risk	Ang et al. (2006); Frazzini and Pedersen (2014)	Ang et al. (2009); Frazzini and Pedersen (2014)	Frazzini and Pedersen (2014)
Profitability	Novy-Marx (2013); Hou, Zhang and Xue (2015); Fama and French (2014)	Ammann, Odoni and Oesch (2012)	N.A.
Investment	Cooper, Gulen and Schill (2008); Hou, Zhang and Xue (2015); Fama and French (2014)	Watanabe et al. (2013)	N.A.

A third important precaution taken by empirical research before jumping to conclusions on the premium for a given factor is to adjust for data-mining or so-called "multiple testing". In fact, standard statistical tests are only valid when we test a given single hypothesis, such as that high book-to-market stocks carry a premium over low book-to-market stocks. However, in practice researchers may run several tests, for example trying out a large number of metrics until they find one that leads to significant results. This is also known as data-snooping or data-mining. To consider why such multiple testing may lead to false inference, consider a simple example. Assume you simulate data for 100 variables (potential "factors") that have a zero mean. You would then expect to find about five variables with a mean ("premium") significantly different from zero. This suggests that, even though the true mean ("premium") on all of the variables ("factors") is zero in the simulation, the statistical inference will tell you that some of the means are significantly positive, as long as you run enough tests.

In order to adjust for this problem, researchers have come up with tighter requirements for significance levels to take into account the possibilities of multiple testing. For example, Harvey, Liu and Zhu (2015) adjust t-ratios that are used for evaluating the significance of factor premia to take into account the fact that researchers have run many tests across hundreds of factors to document their premia. Interestingly, when applying these methods to standard equity risk factors, researchers find that the main factors, such as value and momentum among others, remain statistically significant.

Despite the thorough evidence supporting the existence of premia for the main factors, there is continuous debate over the set of relevant equity factors. In fact, research often debates whether a factor has disappeared or a new factor has appeared. While

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questioning the baseline results and discussing relevant actors is obviously useful, investors in practice should be prudent before making abrupt changes to their set of factors or the associated investment beliefs. As mentioned before, the measurement of a risk premium is highly sensitive to the chosen sample (Merton, 1980), and estimates of factor premia are subject to considerable uncertainty. Therefore, any conclusions based on empirical evidence should only be drawn from studying very long time periods, and conducting tests across different data sets. Moreover, any arguments in favour of the disappearance of standard factors or the appearance of new factors should not be investigated based on empirical evidence alone, but should also consider the underlying economic mechanisms, an issue we turn to in the next section.

Lesson Two: "Being Serious With Data Is Not Enough"

In addition to convincing empirical evidence, the existence of a factor premium should be supported by a compelling economic rationale. Kogan and Tian (2015) make this point prominently when they write: "*We should place less weight on the data the models are able to match, and instead closely scrutinise the theoretical plausibility and empirical evidence in favour of or against their main economic mechanisms.*"

To illustrate why the existence of an economic rationale is an important requirement for considering a factor to be rewarded, it is useful to take the equity market risk premium as an example. From an empirical perspective, the equity risk premium can be statistically indistinguishable from zero even for relatively long sample periods. However, economic reasoning suggests that stocks should have higher rewards than bonds. Clearly, even if the premium for holding equity is empirically well-documented, investors are reluctant to hold too much equity due to its risks. Similar reasoning can be applied to additional equity risk factors. Instead of focusing only on the empirical evidence, investors' due diligence should look at why there should be a risk premium for a given factor in the first place. In other words, investors should ask what the economic rationale for a factor premium is, to form an opinion on its existence and persistence.

The existence of factor premia can be explained in two different ways – a risk-based explanation and a behavioural-bias explanation. The risk-based explanation postulates that the risk premium is compensation to investors who are willing to take additional risk by being exposed to a particular factor. Additional risk exists when assets that correspond to a given factor tilt tend to provide poor pay-offs in bad times, thus exposing investors to a risk of losses in times when their economic situation is already poor, their consumption is low, and marginal utility of consumption is high. The behavioural explanation predicates that the factor premia exist because investors make systematic errors due to behavioural biases such as over- or under-reactions to news on a stock.

Whether such behavioural biases can persistently affect asset prices is a point of contention given the presence of smart market participants who do not suffer

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from these biases. For behavioural explanations to be relevant, it is necessary to assume that – in addition to biases – there are so-called "limits to arbitrage" (i.e. some market characteristics, such as short-sale constraints and funding-liquidity constraints) that prevent smart investors from fully exploiting the opportunities arising from the irrational behaviour of other investors.

If the risk premium can only be explained by behavioural reasoning, it is expected to disappear in the absence of limits to arbitrage. On the other hand, a risk factor with a strong rationale or risk-based explanation is more likely to continue to have a premium in the future. Therefore, it is perhaps more reassuring for an investor to have a risk-based explanation.

We refer to Exhibit 2.6 for a brief list of risk-based and behavioural explanations of each factor.

Exhibit 2.6: Economic Mechanisms behind Main Factors

	Risk-Based Explanation	Behavioural Explanation
Size	Low liquidity, high distress and downside risk is compensated by higher returns.	Limited investor attention to smaller cap stocks
Value	Costly reversibility of assets in place: high sensitivity to economic shocks in bad times.	Overreaction to bad news and extrapolation of the recent past leads to under-pricing
Momentum	High-expected-growth firms are more sensitive to shocks to expected growth.	Investor overconfidence and self-attribution bias leads to returns continuation in the short term
Low Risk	Liquidity-constrained investors have to sell leveraged positions in low-risk assets in bad times when liquidity constraints become binding.	Investor disagreement about high-risk stocks leads to overpricing due to short-sale constraints
Profitability	Firms facing high cost of capital will invest only in the most profitable projects.	Investors do not discern high and low profitability in growth firms
Investment	Low investment reflects firms' limited scope for projects given high cost of capital.	Investors under-price low investment firms due to expectation errors

Lesson Three: "Be practical"

A common criticism of academic research on factor premia is the supposed impracticality of academic factor definitions, simply because most results in academic research abstract from transaction costs and other implementation issues such as turnover. It is indeed the case that many academic studies do not necessarily aim to consider implementation issues. In fact, product providers often justify deviations from academic factors with implementation needs. That said, while early studies indeed abstract away from implementation issues, recent academic research addresses this shortcoming. In particular, recent research examines whether the premia to common equity risk factors survive net of transaction costs. Moreover, recent research assesses whether we can use mitigation strategies to ease implementation when harvesting these premia.

Novy-Marx and Velikov (2014) assess turnover and estimate transaction costs for common factor strategies. They find that the net-of-cost factor premia mostly remain significant. Exhibit 2.7 provides a summary of their findings.

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Exhibit 2.7: Net-of-cost Factor Premia, as Reported by Novy-Marx and Velikov (2014) – See Their Table 3.
All values are monthly. Factors are based on cap-weighted decile portfolios. Portfolios are rebalanced annually for most factors but monthly for low idiosyncratic volatility and momentum. Factors are return differences between two extreme decile portfolios (cap-weighted). The time period is from July 1963 to December 2013.

(Monthly)	Gross premium		Turnover	T-costs	Net premium	
	Avg.	[t-stat]			Avg.	[t-stat]
Size	0.33%	[1.66]	1.23%	0.04%	0.28%	[1.44]
Value	0.47%	[2.68]	2.91%	0.05%	0.42%	[2.39]
Momentum	1.33%	[4.80]	34.52%	0.65%	0.68%	[2.45]
Low Volatility	0.63%	[2.13]	24.59%	0.52%	0.11%	[0.37]
Profitability	0.40%	[2.94]	1.96%	0.03%	0.37%	[2.74]
Investment	0.56%	[4.44]	6.40%	0.10%	0.46%	[3.60]

In addition to assessing whether the returns to simple strategies are robust to transaction costs, research has tested adjusted implementations of factor premium strategies that try to ease implementation. Novy-Marx and Velikov (2014) test several mitigation strategies and find that such approaches can substantially ease implementation while sustaining most of the return benefits, which often results in improvements in net-of-cost factor premia.

Frazzini, Israel and Moskowitz (2012) conduct a similar analysis and find that after taking into account realistic transaction costs, factor premia remain significant, especially when making adjustments to ease implementation: "*We measure the real-world transaction costs and price impact function…and apply them to size, value, momentum, and short-term reversal strategies. […] Strategies designed to reduce transaction costs can increase net returns and capacity substantially, without incurring significant style drift. We conclude that the main anomalies…are robust, implementable and sizeable.*"

Moreover, Amenc, Goltz and Lodh (2012) provide a clear implementation framework for factor-tilted indices in a long-only context with an aim of providing factor-tilted indices that are not only implementable, but also well-diversified. Practical implementation of such well-diversified indices leads to risk/return improvements over simple cap-weighted quintile portfolios,[49] as well as to considerable investability improvements through lower turnover and fewer average days-to-trade at rebalancing (Amenc et al., 2016).

In summary, while much of the early evidence did not consider practical implementation issues, more recent research confirms that the standard factors lead to rewards even net of implementation considerations. Moreover, straightforward adjustments to strategy design that ease implementation lead to even more pronounced premia net of transaction costs. Therefore, there is a strong case that academically-grounded factors can be used to design implementable strategies. Given this evidence, when considering deviating from academic factor definitions, investors should be careful to not throw out the baby (academic grounding) with the bathwater (unrealistic assumptions on implementation issues).

49 - On average across six well-documented factors, diversified multi-strategy indices have a Sharpe ratio of 0.7 compared to an average Sharpe ratio of 0.56 for cap-weighted quintile portfolios.

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Conclusion: What "Academic Grounding" Does Not Mean

The fact of the matter is that many factor investing strategies and indices offered by product providers create a considerable mismatch with academic definitions. Exhibit 2.8 provides an overview of factor definitions retained in several commercially-available factor indices and contrasts them with the Fama and French (2012, 2014) factor definitions, which are widely used in academic research, and which test either the empirical evidence on these factors or assess their economic rationale.

Exhibit 2.8: Mismatch with Academic Factor Definitions – Examples

Provider	Value	Momentum	Quality
Fama-French (2012, 2014)	Price-to-Book	Past 12-month return (omitting last month)	ROE (operating profits divided by book equity)
Goldman Sachs Equity Factor Index World	Value score from proprietary risk model (Axioma) relative to stock's regional industry group	Residuals from cross-sectional regression of 12-month return (omitting last month) on stock volatility	Composite based on asset turnover, liquidity, ROA, operating CF to assets, accruals, gross margin, leverage
MSCI Multi-Factor Indices	Sector-relative composite based on Enterprise Value/ Operating CF, Forward P/E, Price-to-Book	Composite score based on excess return divided by annual volatility over past 12 months and past six months	Composite based on return on equity, standard deviation of earnings, debt-to-equity
FTSE Global Factor Index Series	Composite based on cash flow to price, net income to price, and country-relative sales to price	Mean/Standard Deviation of "average residual" from 11 rolling window regressions of past 36 months returns on country and industry index	Composite based on operating CF to debt, net income to assets, annual change in (sales over assets), accruals
Deutsche Bank Equity Factor Indices	Composite based on inverse of Enterprise Value to EBITDA and dividend yield	12-month return (omitting last month) minus risk adjustment times idiosyncratic volatility score	Composite based on return on invested capital and net operating assets growth

The mismatch between the provider definitions and the standard academic definitions is striking. While the Fama and French definitions rely on straightforward variables and make a choice of selecting one key metric to come up with a factor score for each stock in a transparent and simple way, the proprietary definitions from providers use different sets of variables, as well as various adjustments and often consist of complex combinations of several variables. For example, some factor scores are calculated relative to the industry or regional groups a stock belongs to. Some providers use such industry or region adjustments for certain variables within a given factor score while not using it for other variables that make up the same factor score. Moreover, providers often use variables that are quite far removed from the original factor definition, such as the change in sales over total assets or the leverage in quality scores, as compared to the simple use of a profitability measure by Fama and French. Overall, the different index providers are in stark disagreement with how academic research defines these factors.

In general, such proprietary definitions increase the amount of flexibility providers have in testing many variations of factors and thus pose a risk of data-mining, and all the more so in that it remains unclear why these adjustments are made and in particular whether there are any fundamental economic reasons for using

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some of these variables and adjustments for a given factor. In fact, it appears that providers sometimes explicitly aim at selecting ad-hoc factor definitions which have performed well over short-term back-tests. As an illustration, consider the following statements from white papers that select factor definitions for factor indices based on back-testing various combinations of variables on a particular data set spanning a time period of about 13 years:[50]

- "*For each composite value index, factors are selected on the basis of the most significant t-stat values*"
- "*Our preferred measure of momentum is the Residual Sharpe Ratio, which displays relatively high risk-adjusted performance outcomes, and relatively low levels of volatility*".

Moreover, some providers have launched "enhanced" factor indices which replace the factor definitions in their standard factor indices with new and improved recipes. Of course, selecting proprietary combinations or making proprietary tweaks to variable definitions offers the possibility of improving the performance of a factor index in a back-test. The question is whether the improvement of the "enhanced" factor definition will also hold going forward, especially if there is no solid economic foundation for it. There is clearly a risk that one ends up with what academics have termed "lucky factors". Harvey and Liu (2015) show that by snooping through data on a large number of candidate factors and retaining those with the highest t-stat, one takes the risk of uncovering flukes, which will not repeat out of sample. Perhaps even more importantly, it is unclear what, if anything, factors with extensive proprietary tweaks still have in common with the factors from academic research. Therefore, the empirical evidence in favour of the academic factors and their economic grounding cannot be transposed to such new proprietary factors.

In the absence of a clear relation with standard academic factors, such proprietary factor strategies are merely ad-hoc constructs resulting from product back-tests. In fact, to find out whether any of these new proprietary factors are indeed related to the well-documented academic factors, one would first need to assess how they align empirically with standard factors. This point was also made clear by Eugene Fama in a recent interview. When discussing the topic of the value factor and more proprietary versions of this factor, he states, "*Now everybody talks about value... Some stuff is fly-by-night. There are like 45 versions of that and every guy has their own marketing ploy. The acid test is you put it in the three-factor model and it says it is a value portfolio.*"

In the end, a minimum requirement for good practice in factor investing is to avoid creating a mismatch with academic factors. This can be achieved easily by referring to indicators for which academic research has provided thorough tests and economic explanations, and by refraining from proprietary "tweaks".

Alternatively, when using novel or proprietary factors, one needs to make sure that they are thoroughly tested (i.e. tested in very long-term data, across asset classes, for robustness to data-mining and to transaction costs) as well as linked to economic mechanisms. Of course it seems like a heroic objective for a product provider to

50 - As reported by FTSE Russell (2015a) and FTSE Russell (2015b).

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aim to replicate the work that the whole academic community has conducted on standard factors, only by assessing the robustness of its own proprietary factor. Therefore, one can make a reasonable case that proprietary factors may never be able to reach the amount of thorough testing that their standard academic counterparts benefit from.

Given the strong emphasis providers put on the "academic grounding" of their factor strategies, it is indeed surprising that they then chose to implement products that represent a gross mismatch with academic factor definitions and that do not respect the key academic principle of parsimony. Instead of paying lip service to an "academic grounding" and coming up with a marketing innovation of tweaked factors, perhaps it is time that product providers actually used academic research in their product development. Moreover, investors should hold providers to high standards and conduct thorough due diligence on the soundness of particular implementations of factor investing.

It is also worth emphasising that a key idea behind the use of simple standard factors is to obtain robustness through parsimony. Parsimony refers to the idea that one can explain "a lot" with "a little". While proprietary factor definitions may be able to explain more in-sample, they also pose a risk of picking up noise, which one can avoid with more parsimonious factor definitions such as the standard factors from the literature. The statistician George E.P. Box (1976) famously argued in favour of parsimony by writing that "*over-elaboration and over-parameterisation is often the mark of mediocrity*". Indeed, the parsimony of standard academic equity factor definitions may be preferable to over-elaboration and over-parameterisation of tweaked proprietary factors that are sometimes proposed by product providers.

Smart Beta Replication Costs [51]

- Smart beta strategies typically entail higher replication costs than cap-weighted market indices, but the key question is not whether transaction costs are higher but whether, after accounting for such costs, there are any benefits in terms of net returns.
- Providers should disclose the estimated level of transaction costs generated by their strategies so as to allow for information on net returns, but they typically fail to make explicit adjustments for transaction costs and satisfy themselves with reporting gross returns, leaving it to other market participants to figure out what exactly the transaction costs amount to.
- The results of our research on smart beta replication costs provide an explicit estimate of costs applied to a range of strategies and show the impact of using different implementation rules or stock universes. Given the transparent methodology and benign data needs, our replication cost analysis is straightforward and can be easily applied to other strategies.

An important issue with smart beta strategies is that they typically entail higher

51 - Text prepared with the contribution of Mikheil Esakia, Siva Sivasubramanian and Jakub Ulahel.

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replication costs than cap-weighted market indices. While this is obviously true, the crux of the question is not whether transaction costs are higher but whether, after accounting for such costs, there are any benefits in terms of net returns. A reasonable expectation from an investor's perspective is that providers should disclose the estimated level of transaction costs generated by their strategies so as to allow for information on net returns. However, providers typically fail to make explicit adjustments for transaction costs and satisfy themselves by reporting gross returns, leaving it to other market participants to figure out what exactly the transaction costs amount to. This article sets out to apply methods for explicit cost measurement and to thus draw conclusions on smart beta strategies.

Transaction cost estimates

Easily accessible transaction cost estimates

A first important objective of this research is to test methods which provide easy access to direct transaction cost estimates.

Transaction cost estimates for smart beta strategies are hard to obtain in practice because in principle an accurate estimation requires intraday high frequency data. One needs to observe trades and quotes within the trading day to come up with cost measures. However, not only is such data difficult to access, it is also difficult to use. The increasing frequency of trading has led to a huge amount of tick by tick price data that requires massive computational power for analysis, with some researchers arguing that the growth of high frequency equity even outpaces the growth of computing power. Moreover, tick data requires matching procedures for prices and quotes so that the quality of databases and the cleaning procedures becomes a prime concern. Moreover, high frequency data only covers relatively short time periods, making it impossible to evaluate long-term track records of smart beta strategies.

Recent research has shown that there are effective ways of estimating transaction cost variables that are only observable at high frequency, based on lower frequency (daily) data. We draw on recent advances in microstructure research to extract measures of transaction costs from daily data, such as the daily range between high and low prices and the closing bid-ask spread. Using daily data allows us to analyse longer time periods than would be possible if drawing on high frequency data. Moreover, the methods we use are not computationally intensive and they draw on easily available data, making them easily replicable for practitioners who wish to analyse smart beta strategies.

We follow two types of spread estimation methods based on daily data – one based on Corwin and Schultz (2012) who use daily range measures such as high and low prices to estimate daily spreads (hereinafter referred to as the *range-based* spread estimator), and the other based on Chung and Zhang (2014) who use daily closing quoted bid and ask prices to estimate daily spreads (hereinafter referred to as the *closing spread* estimator).

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While there is substantial literature suggesting that such measures are highly correlated with high frequency cost measures, our assessment indeed confirms that low frequency measures reliably capture the level of costs. In particular, we show that our measures capture the information content of transaction costs (effective spreads) reported by trading venues in compliance with Rule 605 regulations. They also align well with effective spreads extracted from high frequency trade and quote data (TAQ). Compared to estimates from high frequency data, our cost measures are however somewhat conservative in that they tend to slightly overestimate cost levels. This means that any conclusions about the viability of smart beta strategies in the face of transaction costs will also tend to be on the conservative side.

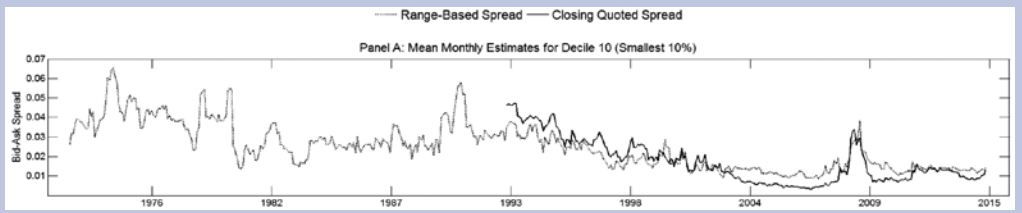
While we apply our cost estimates to a range of smart beta strategies to draw conclusions about cost levels, it is worth emphasising that our transaction cost measurement approach can easily be applied to testing additional strategies. Using methods such as those in this research could help the industry make cost estimates more widely available given the computational ease and widely accessible data such cost estimates are based on.

Transaction cost levels across stocks and over time

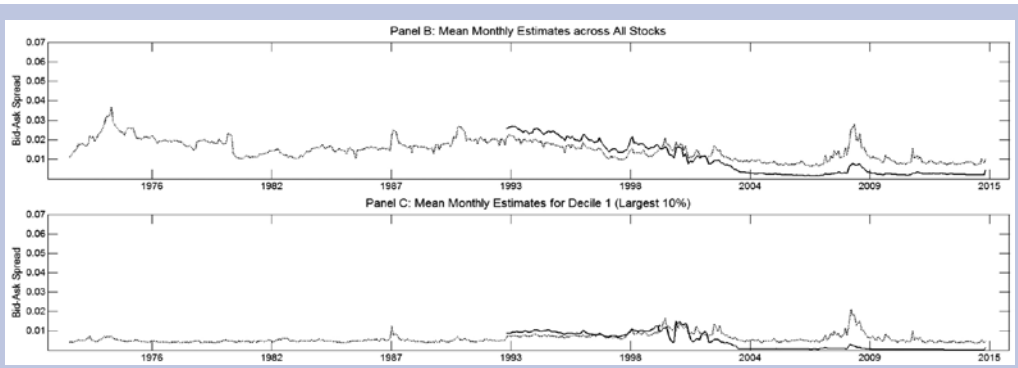
The following exhibit shows results for the average spread across all stocks, as well as the average spreads for the largest and smallest stocks in our universe. Large and small stocks are taken as the top and bottom deciles every year by market capitalisation (as of the last trading day of the previous year). The 3,000 stocks available in every quarter of a given year are aggregated for the decile selection. The number of unique stocks may thus be greater than 3,000 in a given year. Monthly average spread estimates are then calculated for these deciles.

It should be noted that the numbers reported reflect full spreads (rather than half spreads). Therefore, the spread estimates reflect the average transaction costs for a round trip trade in the given universe of stocks.

Exhibit 2.9: Effective Spread Estimates: Top 3,000 US Stock Universe
The figure shows the mean monthly spread estimates based on two estimators – the Range-Based Spread Estimator and the Closing Quoted Spread Estimator. Reported spreads are mean monthly 2-way spread estimates. Our sample universe consists of the 3,000 largest ordinary common stocks in the United States in each quarter based on market capitalisation. As the universe is re-sampled every quarter there may be more than 3,000 stocks in a given year. The daily spread estimate of each stock is estimated based on the chosen estimator. Monthly spreads of each stock are calculated as the average of daily spread estimates of those stocks with at least 12 days of daily spread estimates in a given month. The mean monthly spreads of top decile stocks (largest 10% of stocks), bottom decile stocks (smallest 10% of stocks) based on market capitalisation and the mean monthly spreads across all stocks in our sample universe are reported for each type of estimator. Range-Based spread estimates are estimated from January 1973 to December 2014, and due to limited data availability closing quoted spread estimates are estimated only from January 1993 to December 2014. Data Source: CRSP.



2. Background



The results suggest that both of our estimates provide similar overall results. The results also allow interesting conclusions to be drawn on the level, the time-series variation, and the cross-sectional variation of transaction costs. The average spread across all stocks had frequently reached values above 2% in the 1970s, but is situated clearly below 1% in the recent part of the sample. In such an equal-weighted average across 3,000 stocks, small stocks with high spreads obviously have a high influence. When looking at the top decile (i.e. the 300 largest stocks by market cap), the spread has taken on typical values in the area of 0.5% even during the early periods such as the 1970s. In contrast, the smallest decile stocks had historically reached spread levels exceeding 5%. We also observe spikes in the spread estimates which correspond to a liquidity crisis. In particular, spikes are observed in the period from late 2008 to early 2009 – a period which saw major bank failures and a drying up of liquidity.

It is worth discussing how transaction costs behaved at points when market structure changed. In the US stock market, there are a few notable points when minimum tick sizes declined. The first change occurred in 1997 when the tick size was reduced from 1/8th to 1/16th, and the second major reduction occurred in 2001 when the tick size went from 1/16th to 1/100th (i.e. decimalisation). Smaller tick sizes allow for more competitive spreads. We can see that there is indeed a general reduction in spread levels if we compare the period prior to 1997 to the period after 2001.

Analysing smart beta strategies

We apply the transaction cost estimates to several smart beta strategies to draw conclusions on their implementability. For our cost estimates, we use the closing spread estimator for the period when data is available, and the range-based estimator prior to that. Our empirical analysis leads to several important conclusions in terms of replication cost estimates for smart beta strategies, which we summarise and illustrate below.

Transaction costs and implementation challenges crucially depend on the stock universe

First, we find that conclusions about transaction cost levels and strategy implementation challenges are heavily dependent on the stock universe used. While

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it is common to see broad brush statements about investability hurdles for particular smart beta strategies, our results provide clear evidence that conclusions depend heavily on the universe under consideration. Our results on generic strategies show that cost metrics and investability metrics differ tremendously across universes.
A summary of results is shown in the following exhibit. We assess different universes where we select the largest 250, 500, 1,000 and 3,000 stocks to reflect different investment universes with different levels of liquidity as a starting point for implementing smart beta strategies. We then analyse portfolios drawing on random selections from these universes to assess outcomes for different weighting schemes and universe sizes chosen. To assess generic weighting schemes, we look at market cap-weighting as well as two non-cap-weighted weighting schemes, namely weighting based on firm fundamentals and equal-weighting.

Exhibit 2.10: Implementation Costs of Generic Alternative Weighting Schemes (USA Long-Term Track Records (LTTR) – Long Term – 42 Years)
The time period of analysis is 31-Dec-1972 to 31-Dec-2014. All statistics are annualised and daily total returns in USD are used for this analysis. From the 3,000 largest stocks in the USA, universes comprising the 250, 500, 1,000 and 3,000 largest stocks are chosen and from each universe 1,000 random samples of 100 stocks are selected and weighted according the generic weighting scheme chosen. Average statistics across random portfolios are reported below. Data Source: CRSP, Compustat.

USA Long-Term	Number of Stocks in the Universe			
31-Dec-1972 to 31-Dec-2014	250	500	1000	3000
Transaction Costs				
Cap-Weighted	0.04%	0.04%	0.04%	0.05%
Equal-Weighted	0.13%	0.14%	0.17%	0.38%
Fundamental-Weighted	0.11%	0.12%	0.13%	0.16%
Days-to-Trade (95 %ile)				
Cap-Weighted	2.06	2.39	3.79	9.99
Equal-Weighted	3.56	5.35	12.74	107.30
Fundamental-Weighted	2.48	2.93	4.80	15.13

These results underline the dependence of implementability on the universe used as a starting point. For example, for portfolios built from the top 250 stocks by market cap, we obtain days-to-trade measures of 3.56 days for equal-weighted portfolios compared to 2.06 for the cap-weighted portfolios in the same universe. Moreover, the estimate of average annualised transaction costs is 0.13% for the equal-weighted portfolios compared to 0.04% for the cap-weighted portfolios in the same universe. When looking at portfolios formed from the broad universe (the top 3,000 stocks by market cap), we get strikingly different results. The days-to-trade measure reaches more than 100 for equal-weighted portfolios compared to about 10 for cap-weighted portfolios. Estimated transaction costs are 0.38% for equal-weighted portfolios compared to 0.05% for cap-weighted portfolios. Thus an equal-weighting strategy indeed looks extremely challenging to implement for the broad universe, but implementation measures are rather well-behaved for the large-cap universe. Given such differences, it makes little sense to make statements about the investability of any given strategy per se without considering the universe it is implemented for.

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Practical implementation rules effectively ease liquidity and cost issues

Our analysis provides evidence of the usefulness of practical implementation rules. Our results suggest that whether or not smart beta strategies face implementation hurdles depends on the set of implementation rules that have been included in the design. We test available index strategies by comparing them to stylised portfolios that omit the implementation rules applied in practice. Our results suggest that smart beta strategies may indeed appear challenging to implement when abstracting from commonly used implementation rules, but applying these rules leads to different conclusions. For example, we report results (see the following exhibit) for a Minimum Volatility strategy before applying implementation rules and compare this to the same strategy after such rules have been incorporated. We show that estimated annualised transaction costs change from 0.38% to only 0.18% and investability measures such as days-to-trade go from 3.14 to 2.19 when applying practical investability rules. Perhaps more importantly, amounts traded in any stock relative to its market-cap weight decline drastically from a trading multiple of 15 to a multiple of around 1. Applying common sense implementation rules thus reduces transaction costs and limits any stress on available trading volume.

Exhibit 2.11: Impact of Turnover and Liquidity Rules on Minimum Volatility Strategy
The time period of analysis is 31-Dec-1972 to 31-Dec-2014. All statistics are annualised and daily total returns in USD are used for this analysis. See Exhibit 10 in the main part of the paper. Data Source: CRSP, Scientific Beta.

USA LTTR Long-Term 31-Dec-1972 to 31-Dec-2014	Efficient Minimum Volatility		
	Before Turnover and Liquidity Rules	After Turnover but Before Liquidity Rules	After Turnover and Liquidity Rules
One-Way Turnover	54.57%	37.96%	30.02%
Transaction Costs	0.38%	0.29%	0.18%
Days-to-Trade (95 %ile)	3.14	3.13	2.19
Trading Multiple (99 %ile)	15.53	9.64	1.30

Replication costs of practical smart beta strategies

Third, we find that for the set of indices included in our analysis, which respect a set of implementation rules, smart beta performance benefits largely survive transaction costs. When looking at commonly used smart beta indices that are built on liquid universes and integrate implementation rules, the impact of transaction costs on returns is small, far from cancelling out the relative return benefits over cap-weighted indices. Transaction costs are an order of magnitude smaller than relative returns, meaning that net relative returns do not differ materially from gross relative returns. For the three strategies we consider, namely a Minimum Volatility, Maximum Deconcentration and Multi-Factor index, we find that average annualised transaction costs over the 42-year period are between 0.13% to 0.18%, while gross returns relative to the cap-weighted index range from 2.38% to 3.93%. The following exhibit shows five-year rolling window returns, both net and gross returns. For brevity, the graphs show the average return across the three strategies analysed. It is rather clear from inspecting the lines for net and gross returns that

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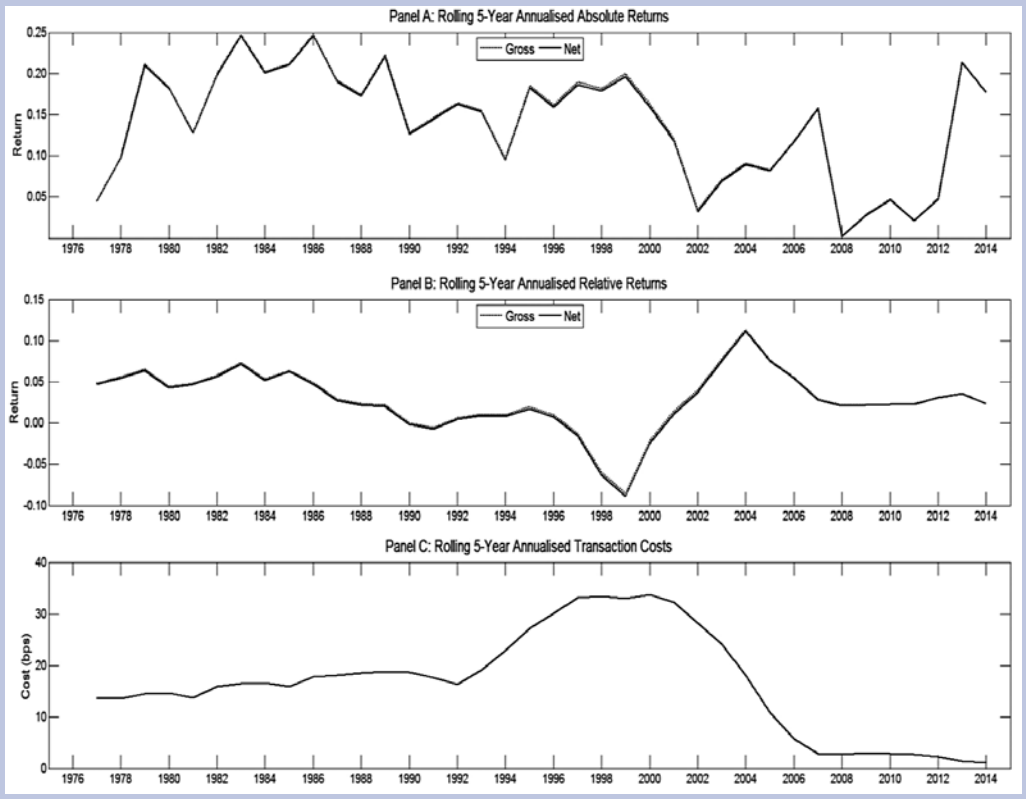
transaction costs hardly alter the returns of these strategies. However, it should be noted that such a conclusion cannot hold for smart beta strategies in general, as emphasised in our first two findings. For example, with a less liquid universe or less stringent implementation rules, the same strategies may be burdened by much higher transaction cost levels and implementability issues.

Exhibit 2.12: Rolling Window Analysis (Average across Three Strategies; USA Long-Term Track Records)
The exhibit presents the average annualised gross and net returns, gross and net relative returns and transaction costs of the three smart beta strategies – the SciBeta USA LTTR Efficient Minimum Volatility Index, the SciBeta USA LTTR Maximum Deconcentration Index and the SciBeta USA LTTR Multi-Beta Multi-Strategy (4-Factor) EW Index using a rolling 5-year window with 1-year step size. Panel A presents the gross and net absolute returns; Panel B presents the gross and net relative returns; Panel C presents the transaction costs. The average returns/costs of the three smart beta indices each year are plotted. The time period of analysis is 31-Dec-1972 to 31-Dec-2014. All statistics are annualised and daily total returns in USD are used for this analysis. The transaction costs estimates use the spread estimates according to the year of the rebalancing – Range-Based spread until 1993 and Closing Quoted Spread from 1993 onwards. The reported transaction cost estimates are the difference between the annualised gross and net returns. Net returns are obtained after accounting for transaction costs at each quarterly rebalancing by multiplying the change in weight of each stock between the final weight before rebalancing and the optimal weights after rebalancing, including stock deletions and additions.



Managing switching costs into smart beta strategies

Another aspect which is important to analyse is the potential cost of switching into smart beta strategies, when investors replace a currently invested portfolio with a new strategy. As a reasonable starting point from which the switch occurs, one can assume a cap-weighted portfolio based on the underlying index universe. It should be noted that investors can manage the cost of switching from cap-weighted indices to smart beta strategies in a straightforward way by stretching out the transition from a cap-weighted portfolio to a smart beta strategy. In the following exhibit,

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we address both the transaction costs that occur through rebalancing and those that occur when initially switching from a cap-weighted index to the smart beta strategy. In order to estimate switching costs for a 10-year investment period, we apply trading cost estimates to the trades needed to switch from the cap-weighted index to the smart beta index and compute the corresponding annualised costs assuming that the switch is done for a subsequent investment period of 10 years.
It can be seen that stretching the transition over a period improves the days-to-trade but the returns remain almost the same. The tracking error between the stretched and non-stretched portfolios also remains quite low although they increase in the stretch period. The cost of transition is very small compared to the cost of rebalancing and the total cost is still low compared to the gross returns even after accounting for the transition costs.

Exhibit 2.13: Comparison of Stretched and Non-stretched Transition from Cap-Weighted Portfolio to Smart Beta Portfolio (Long Term - 42 Years)
The time period of analysis is 31-Dec-1972 to 31-Dec-2014. The strategies considered for this analysis are the SciBeta USA LTTR Efficient Minimum Volatility Index, the SciBeta USA LTTR Maximum Deconcentration Index and the SciBeta USA LTTR Multi-Beta Multi-Strategy (4-Factor) EW Index. All statistics reported in Panel A are quarterly estimates and are averaged across all quarters. Results of three types of scenarios are estimated and presented – i) The switch from Cap-Weighted portfolio to Smart Beta portfolio happens completely on the day of rebalancing (1-day Transition); ii) The switch from Cap-Weighted portfolio to Smart Beta portfolio happens equally distributed across 10-days (10-day Transition i.e. assuming only one-tenth of the portfolio switches every day for 10 days); iii) The switch from Cap-Weighted portfolio to Smart Beta portfolio happens equally distributed across 20-days (20-day Transition i.e. assuming only one-twentieth of the portfolio switches every day for 20 days). Days-to-Trade (DTT) is reported as a time-series average of the cross-sectional 95th percentile of DTT at each quarterly rebalancing. Tracking Error of stretched transition (both 10-days and 20-days) over non-stretched transition is computed quarterly and average is reported. Difference in Gross Returns is computed quarterly between stretched (both 10-days and 20-days) transition and non-stretched transition. All statistics reported in Panel B are annualised. It compares costs of all three smart beta strategies. Assuming 10 year investment period, the Annualised Cost of Transition from Cap-Weighted Index is computed as one-tenth of the immediate transition (a semi-absolute difference between weights of smart beta strategies and Cap-Weighted index multiplied by the average weighted spread and averaged across all quarters). Annualised Cost of Rebalancing is the average difference between annualised gross and net returns. Total Annualised Cost is sum of transition and rebalancing costs.

USA LTTR Long-Term 31-Dec-1972 to 31-Dec-2014	Transition	Efficient Minimum Volatility	Maximum Deconcentration	Multi-Beta Multi-Strategy 4-Factor EW
Panel A: Transition from Cap-Weighted Index (Statistics for Transition Quarter)				
Days-to-Trade (95%ile)	Non-stretched	1.72	1.98	2.64
	Stretched 10-days	0.17	0.20	0.26
	Stretched 20-days	0.09	0.10	0.13
Tracking Error	Non-stretched	-	-	-
	Stretched 10-days	0.08%	0.08%	0.09%
	Stretched 20-days	0.12%	0.11%	0.12%
Difference in Gross Returns by Stretching	Non-stretched	-	-	-
	Stretched 10-days	0.00%	0.01%	0.00%
	Stretched 20-days	-0.01%	0.00%	-0.01%
Panel B: Cost Comparison				
Annualised Cost of Transition from Cap-Weighted (assuming 10 year investment period)		0.02%	0.02%	0.03%
Annualised Cost of Rebalancing		0.18%	0.13%	0.17%
Total Annualised Cost		0.20%	0.15%	0.20%

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Conclusions

The results of our research provide an important contribution to the analysis of smart beta strategies from a practical perspective. Indeed, the state of affairs in the evaluation of smart beta strategy performance is far from satisfying. On the one hand, strategy providers do not commonly report the transaction cost estimates of their strategies and performance evaluation often relies on simulated gross returns. On the other hand, discussion of cost issues more often than not remains at the level of blanket criticism aimed at certain strategies, without considering the universe or the implementation rules that are used. Our results provide an explicit estimate of costs applied to a range of strategies and show the impact of using different implementation rules or stock universes. Importantly, given the transparent methodology and benign data needs, our replication cost analysis is straightforward and can be easily applied to other strategies.

Smart Beta Strategies in Fixed-income [52]

- The question arises as to whether smart beta strategies will prove effective for the fixed-income asset class.
- We put the search for factors and beta strategies in the context of asset pricing, and we show that compensation for non-market factors is not just allowed, but actually required, by financial theory.
- We explain the various questions answered by time-series and cross-sectional analyses of risk premia and then focus on fixed-income instruments, presenting the time-series and cross-sectional formulations for the search of priced risk factors.
- We finally explain the unique challenges encountered in identifying priced risk factors in fixed-income products and present the main findings obtained to date.

In the last decade, the search for priced non-market equity risk factors, and the implementation of smart beta strategies for equities have been a major focus of applied and theoretical research. It is now generally acknowledged that, *in the equity space*, these strategies permit the construction of more desirable portfolios than naive passive allocations (such as equal or market-capitalisation weighting schemes).

Recently, this focus has been shifted to other asset classes (see, e.g. Asness, Moskowitz and Pedersen, 2013) and to fixed-income in particular. Given the huge size of the fixed-income market,[53] the natural question is whether smart beta strategies will prove effective for this asset class.

In this article:

- we put the search for factors and beta strategies in the context of asset pricing, and we show that compensation for non-market factors is not just allowed, but actually required, by financial theory;
- we explain the different, and complementary, questions answered by time-series and cross-sectional analyses of risk premia;

52 - Text prepared by Riccardo Rebonato

53 - According to the BIS, the size of the global debt market is approximately $22tn (as reported in the *Financial Times*, November 10, 2016, page 18, Lex).

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- we then focus on fixed-income instruments, and present the time-series and cross-sectional formulations for the search of priced risk factors;
- we explain the unique challenges encountered in identifying priced risk factors in fixed-income products;
- we present the main findings obtained to date;
- we suggest avenues for fresh research.

Throughout the presentation, we emphasise the dangers of data-mining, and therefore place great emphasis on the importance of finding some cogent explanation for the putative factors.

Excess Returns – Background

In the first incarnation of the "modern" approach to asset pricing (the body of work that, starting from Markowitz (1952), led to the CAPM (Treynor, 1961; Sharpe, 1964; Lintner, 1965), the excess return earned by any security was derived to be proportional (via the famous "market beta") to a single factor – the market excess return over the riskless rate.

As a corollary to this result, it followed that (barring leverage) increasing exposure to the market factor was the only way for an investor to increase excess return.

The CAPM has fared better theoretically, and indeed among practitioners,[54] than empirically. Indeed, statistical tests have robustly and convincingly rejected the validity of the CAPM model. This rejection did not imply, however, that the market factor played no role in explaining excess returns. Rather, the empirical studies revealed the untenable claim that the market factor was the only factor, and suggested that additional, non-market, factors, could have significant explanatory power: the market risk factor had to be complemented by other explanatory variables, these empirical studies said, not *tout court* jettisoned. These empirical studies were silent, however, as to the nature of the additional factors.

Is it reasonable to accept the existence of non-market factors? It certainly is, both normatively and descriptively. A positive risk premium reflects the compensation for the fact that a security is expected to pay well in states of the world when investors are doing well (high-consumption states), and to have poor pay-outs when investors feel poor (low-consumption states). Now, the CAPM implicitly assumes, among other things, that investors only draw their income (and hence derive their consumption) from their investment portfolios. If this were true, high and low consumption would indeed only be linked to the performance of the market portfolio.

In reality, investors face a number of macroeconomic risks to their consumption stream: unemployment, for instance, would affect their labour income; inflation would erode the nominal value of their nominal assets; productivity shocks are known to be related to stock returns; etc.[55]

In principle, every source of consumption risk can therefore command a compensation for bearing that risk, and hence a risk premium.

This line of thought led to extensions of the CAPM model in which several consumption-affecting factors were allowed to influence the expected returns of

54 - "Even though the CAPM is firmly rejected by data, it remains the workhorse of finance: 75% of finance professors advocate using it, *and 75% of CFOs employ it in actual capital budgeting decisions*", Ang (2014), page 197, emphasis added. See also Welch (2008) and Graham and Harvey (2001), quoted therein.

55 - Ang (2014) reports a 48% correlation between a five-year moving average of productivity shocks and stock returns. In real business cycle models, productivity shocks affect not only stock returns, but also growth, investments and savings, and therefore indirectly affect non-investment consumption – for instance, through wage growth.

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stocks.[56] This, in turn, motivated, or at least provided the theoretical justification for, the empirical search of non-market factors.

In parallel, studies in behavioural finance and in the institutional workings of financial markets pointed, on the one hand to the bounded rationality of investors,[57] and on the other to the "frictions" that taxes, laws, and regulations impose on the functioning of the financial system. For the present discussion the important point is that both these sources of "imperfection" ("irrationalities" and "frictions") could in principle introduce new explanatory variables (which may, but need not, be proper "factors") to account for excess returns.

An Expression for the Factors

These qualitative considerations can be made more precise as follows.

Consider first the statistical regression of the excess return, r_i, over the riskless rate, r_f, from security i, on the market excess return, $r_m - r_f$:

$$r_i - r_f = \alpha_i + \beta_i^m (r_m - r_f) + \epsilon_i \quad (1)$$

If we take Equation (1) purely as a statistical regression, there are no constraints on the intercepts. As we discussed, the CAPM makes the strong statement that all the intercepts, α_i, should be statistically indistinguishable from zero, (and that the residual should be uncorrelated with the left-hand variables).

If one empirically finds, as one does, that some intercepts are statistically different from zero, then finding "factors" can be described as the identification of n non-market-return variables, x_i, such that

$$r_i - r_f = \alpha_i' + \beta_i^m (r_m - r_f) + \sum_{k=1,n} \beta_i^k x_k + \eta_i \quad (2)$$

with the new intercepts of α_i' now either zero or at least such that

$$\sum w_i |\alpha_i'| < \sum w_i |\alpha_i| \ . \quad (3)$$

(In the equation above, the quantities w_i are the weights in the market portfolio.)

The identification of new factors turns at least a part of the "undigested" intercepts of the CAPM-inspired regression (the α_i in Equation (1)) into new interpretable "betas" (the β_i^k in Equation (2)).

In the equity space, where most of the theoretical and empirical work has been carried out, Fama and French (1993) pioneered the search for the factors x_k. In their early work they identified, in addition to the market portfolio, two additional factors: the small-minus-big factors, and high-minus-low factor (where "small" and "big" refer to the size of a firm, and "high" and "low" to the ratio of the book-to-market value).[58]

In the wake of these findings, an immense literature blossomed on the search for additional explanatory variables of excess returns. Regression studies which directly used macroeconomic variables as factors were met with limited success. Given the difficulty to quantify macroeconomic variables (think, for instance, of creating a

56 - The first to include macro factors in equities in the cross-sectional search for systematic source of risk were Chen, Roll and Ross (1986).
57 - And to the difficulty in arbitraging these irrationalities away (see, e.g. Shleifer and Vishny, 1997).
58 - More precisely, the Fama and French factors were factor-mimicking portfolios, i.e. long-short portfolios of stocks that would mimic the factors of interest.

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time-series of productivity shocks), the practices therefore became common first to use well-identifiable traded proxies,[59] and then to use an array of market-observable variables that were posited to have some link to a consumption risk story.

The degree of theoretical rigour and statistical robustness of these studies varied greatly.[60] So, alongside the factors that traditional asset pricing theory would readily understand, a richly populated menagerie of more opaque "anomalies" was born.[61] Admittedly, it did not always prove easy – albeit not beyond the ken of an ingenious financial economist – to "map" these empirically determined factors to the sources of consumption risk that would justify calling them "factors".

After the initial research dust settled, the academic and practitioner consensus in equities finally coalesced around the proposition that a small number of robust factors (from which the small-minus-big was often dropped and to which the momentum frequently added) could be identified.

When a statistically sound and economically principled approach to factor identification has been employed, the implications of these findings for asset management have been profound. As new, robust (and sometimes economically interpretable) factors were identified, portfolio weighting schemes other than the market capitalisation were soon created in the equities arena that would tilt the portfolio composition towards the non-market rewarded factors.

The degree and nature of the weight tilt would be determined in such a way as to exploit diversification in order to obtain what the CAPM had claimed to be unattainable: a higher-than-CAPM return for the same risk; or a lower-than-CAPM risk for the same return. Since in the old CAPM world the only way to gain extra unleveraged return was to increase the exposure to the market beta, the new, CAPM-beating portfolio weighting schemes became known as "smart beta" strategies. Their success in the equity space has been widely documented, and it is now an established, text-book "fact" of asset pricing. See, e.g. Ang (2014).

Smart Beta: From Time-series to Cross-sectional Analysis for Fixed-income

Until very recently, the search for risk premia and excess returns had a very different complexion in the fixed-income arena. Most of the studies were focused on (mainly US-issued) Treasury bonds, for which good quality data has been available for decades. However, the high degree of correlation among Treasuries (it is well known that two or three principal components explain over 95% over the observed price variations) makes the identification of *cross-sectional* differences less promising than for equities. Time-series analysis of excess returns has therefore been prevalent for government bonds, and the associated research programme that until very recently was their staple diet of risk-premium research in fixed-income can be summarised as follows.

Given a set of state variables, x_i, that describe the (typically Treasury) yield curve (such as principal components), under no-arbitrage the time-t returns on a fixed-income bond of maturity T, P_t^T, are given by

59 - For instance, the VIX index is an obvious proxy for volatility risk.

60 - As Fama famously said, abandoning the requirement to link a factor to a cogent consumption story was equivalent to issuing a "fishing licence". The dangers of data mining are particularly salient in this context, given the large amount of data required to create a training and a back-testing set. See, e.g. Abu-Mostafa, Magdon-Ismail and Lin (2012) in this respect.

61 - The distinction between "true" risk factors and "anomalies" is not a purely nominal one: "true" risk factors are not washed away by discovering them, as they remain the market compensation for receiving large payoffs in good states of consumption, and *vice versa*. Behaviourally driven irrationalities, instead, may be corrected by sufficiently well capitalised arbitrageurs (such as hedge funds); and as for institutional frictions, these can disappear at the stroke of a regulatory pen.

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$$\frac{\mathbb{E}\left[P_{t+dt}^{T-dt}\right]-P_t^T}{P_t^T}=\left(r_t^f+\frac{1}{P_t^T}\sum_i\frac{\partial P_t^T}{\partial x_i}\lambda_i\sigma_{x_i}\right)dt \quad (4)$$

where σ_{x_i} is volatility of the *i*th factor and λ_i its associated market price of risk. If the "market prices of risk" are assumed to depend on the state variables,

$$\lambda_i=\lambda_i\left(x_1,x_2,..,x_n\right)$$

the search for time- (state-) dependent risk premia boils down to

- identifying for which state variables the market price of risk is not zero;
- for these "rewarded" state variables, identifying the dependence of the market price of risk on the state variables – in the last decade there has been the vibrant research programme associated with the search for the return-predicting factors, i.e. with linear combinations of state variables which have ex ante (predictive) power about the sign and magnitude of the excess returns.

For instance, for Treasuries, the rewarded variable has been found to be the (uncertainty in) level of the yield curve (the first principal component), but the magnitude of the reward mainly depends on the return-predicting factor slope (the second principal component). Of course, the dependence of the market price of risk on the state variables introduces time dependence to the risk premia.

Until the mid-2000s cutting-edge research in Treasury risk premia was (and still is) focused on the identification of return-predicting factors more efficient than the slope. See, e.g. Cochrane and Piazzesi (2005), Cieslak and Povala (2010, 2015), and the references therein.

Time-series and cross-sectional studies are both valuable, but answer different questions. When the state and time dependence of the risk premium for a given asset class is investigated via a time-series analysis and the identification of a return-predicting factor, the question being answered is whether "today" is a good or bad time to invest (be "overweight") in the asset class as a whole. When the cross-sectional differences within a given asset class are explored, the question being answered is to which securities within the asset class one should give more weight, given that an investment in that asset class "has to" be made.

In the fixed-income area, time-series analysis has typically resulted in the decision of whether to construct a portfolio with longer or shorter duration than the benchmark. A cross-sectional analysis has typically been approached via cheap/dear analysis using empirical (Nelson-Siegel, 1987) or structural (see, e.g. Kim and Wright, 2005; Adrian, Crump and Moench, 2013, 2014)) models. In the fixed-income area, this type of analysis has usually been "tactical" in nature, and has typically given rise to the construction of duration-neutral relative-value portfolios.

This state of affairs is rapidly changing. In the last few years practitioners and academics have begun to look at fixed-income products from *a smart beta (cross-sectional) perspective*. Given the size of the international government and corporate debt outstanding, the lateness of this development is at first blush surprising.

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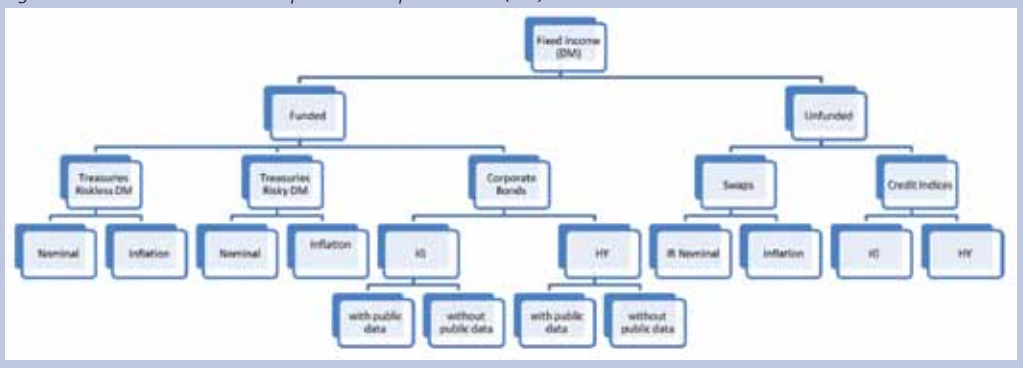
This lateness can be partly accounted for by the relative poverty of the data quality for large sections of the fixed-income universe. Another, and arguably more compelling, explanation is the sheer complexity of the fixed-income lay of the land, some salient aspects of which are shown in Fig (1) (which only looks at Developed Market, DM).

Figure 1: The Fixed-Income landscape for Developed Markets (DM)



As the picture shows, under the capacious tent of the "fixed-income" denomination one gathers

- truly riskless government debt,
- "somewhat"-to-extremely credit-risky government debt,
- corporate debt that ranges in creditworthiness from better than most government instruments to junk,
- real and nominal bonds (which come in government and corporate flavour),
- funded and unfunded (i.e. cash versus swap) instruments,
- corporates for which public data are available (and for which accountancy-related characteristics can be extracted) and corporate for which this is not possible.

Securitised products have been excluded from this classification.

Not surprisingly, empirical studies so far have focused on (often rather limited) subsections of this investment universe. We briefly review in the next section some of the more salient findings.

Empirical Findings to Date

Looking at the results with a broad brush, one can say the following.

For corporate bonds, it is easy to explain yield changes, but difficult to explain spread changes. When the attempt has been made to find explanatory variables to account for spread changes (see, e.g. Collin-Dufresne, Goldstein and Martin, 2001), both the theoretically-motivated variables[62] and the ad-hoc factors have been shown to have a limited explanatory power, with R^2 ranging from 19% to 25%.

It was also found that the first principal component of the residuals could explain a very large proportion of the observed variability. Therefore firm-specific factors are unlikely to account for the residuals: there is likely to be an important systematic factor that can account for the bulk of changes in credit spreads (as opposed to in yields), but we still don't really know what it is.

62 - If one looks at a risky debt from an option-theoretical perspective (a put on the value of the assets), one would expect volatility, the interest rate level and the degree of in-the-moneyness to affect the value of the default option. These were the "fundamental" quantities.

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One could, of course, take the first principal component of the residuals as the "factor", but this would not allow any meaningful economic interpretation, and there would be no guarantee of the stability of this factor.

Howling and van Zundert (2014) find empirical evidence that "the Size, Low-Risk and Momentum factors have economically meaningful and statistically significant risk-adjusted returns in the corporate bond market". They find that their factors can be combined to form a more attractive (better Sharpe Ratio) overall portfolio, and that the results are robust when transaction costs are included, when the factor proxies are defined somewhat differently, and when the portfolios are built in different but reasonable ways.

The low-risk factor is echoed in the work by de Carvalho et al. (2014), who find that low-volatility bonds have better Sharpe Ratios than high-volatility bonds. However, the Sharpe Ratio associated with some of these low-volatility portfolios may well be high, but the leverage required to make the expected returns comparable to, say, expected returns from equities can be as high as 50 or 60. (This, by the way, may well be an explanation of why the "anomaly" is there in the first place.)

It has been claimed that more efficient portfolios can be built by reducing exposure to corporates or sectors with large issuance size. For individual corporates, of course, the variable of interest is leverage, not debt size per se, but this quantity is only computable for companies with public data. As for "excessive" issuance in particular sectors, the "explanation" of why size may be negatively correlated with performance points to debt issuance "bubbles" (such as the volume of issuances for Telecoms or tech companies in 2000, or for financials in 2005-2006).

Liquidity affects different issuers to very different extents, and is poorly correlated with creditworthiness: Italy, for instance, has a similar credit spread (to German Federal *Bunds*) as Spain, but the issuance size, and hence the normal-times liquidity, is much larger in *BTP*s (Italian government bonds) than in *Bonos* (Spanish government bonds). Much work needs to be done in this area, which is one of the least explored (probably because of the difficulty in constructing "non-tautological" proxies).

Momentum has been observed in fixed-income as well, but the choice of the trailing window is delicate and the optimal choice for the length of the momentum "run" is not universal. Short-term mean-reversals have been observed to compete with momentum, complicating the analysis.

Value has been found difficult to define in the case of bonds. For issuers for which reliable yield curves can be built (mainly government bonds, bonds issued by semi-government agencies, and a handful of corporates) cheap/dear analysis has been successfully undertaken by market practitioners for a long time, but few, if any, systematic studies have appeared in the literature. Asness, Moskowitz and Pedersen (2013) provide a (not obviously intuitive) proxy for value, and find that high "value" bonds tend to perform better than low "value" ones.

It must be stressed that evidence of value and momentum factors has been found across a number of asset classes (stocks, Treasuries, corporate bonds, currencies commodities). This suggests that ad-hoc explanations are unlikely to be valid: "The

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strong correlation structure among value and momentum strategies across such diverse asset classes is difficult to reconcile under existing behavioural theories, while the high Sharpe Ratios of a global [. . .] diversified portfolio presents an even more daunting hurdle for rational-risk-based models." (Asness, Moskowitz and Pedersen, 2013).
Finally, the "fallen angels" effect (which is a classic example of a "friction" generated by a regulatory-like constraint) seems to still be present, although downgrade-tolerant strategies are becoming increasingly widespread.

Conclusions
In this note, we have put into context the recent cross-sectional studies of excess returns in the fixed-income space. We have highlighted both the promises and the difficulties associated with the identification of these fixed-income factors. Many seem to be variants of the factors that have already been identified for equities. As the value factor shows, however, the "transliteration" from one asset class to another often requires careful handling.
A convincing economic interpretation of the factors still remains elusive: if anything, having found similar factors at play in the fixed-income market makes their economic justification more, not less, challenging.
Overall, it seems fair to say that "fixed-income smart beta" is an exciting new area of research, where a lot of empirical and theoretical work still needs to be carried out to build a convincing, and practically-exploitable understanding of which factors are "really there", of why they exist in the first place, of how they can be best captured, and of how desirable portfolios can be built.

We proceed now to the presentation of the survey methodology and data. The main results of the survey – European investors' views and use of ETFs and smart beta and factor investing strategies – are found in Section 4.

3. Methodology and Data

3. Methodology and Data

3.1. Methodology

The EDHEC European ETF and Smart Beta Factor Investing Survey 2018 was completed using an online questionnaire distributed to professionals within the European asset management industry, and subsequent e-mail communication with them. This survey targeted different professional asset managers that have experiences with ETF instruments and smart beta strategies, including institutional investors, asset management companies and private wealth managers.

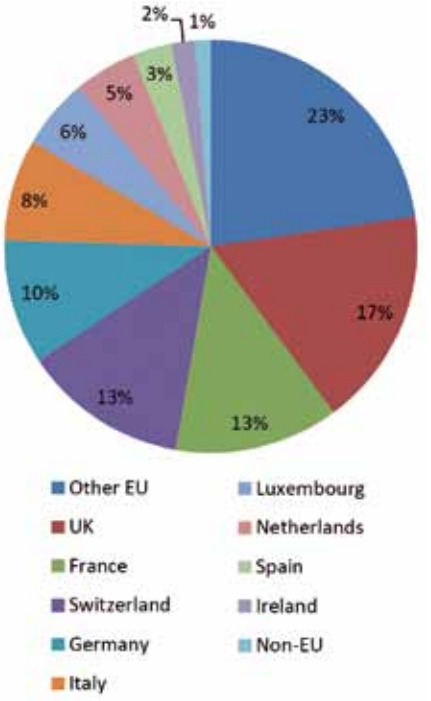
The questionnaire consisted of two main sections. In the first section, the survey participants are asked about the role ETFs play in their asset allocation decisions, as well as about their satisfaction with different ETF products. We also invited the survey participants to express how they view their use of the ETFs for the coming years, as well as to indicate the type of ETF products they would like to see further developed. The second section of the questionnaire is dedicated to smart beta strategies, relating to the recent considerable development in smart beta indices. Respondents were asked to provide their opinions on products that track smart beta indices. They were asked about their current use of smart beta and factor investing solutions in their portfolio allocation, the difficulties they are facing and their needs in terms of further development in alternative equity beta strategies.

3.2.Data

The e-mail containing a link to the questionnaire was sent out in February 2018. The first response was received on 13 February and the last on 6 April. In total, we received 163 answers to our survey, among which 9% (15 respondents) declared that they have never invested in ETFs. However, as a large part of the survey was dedicated to smart beta and factor investing strategies, these participants were invited to skip the ETF part of the survey and directed to the second part of our survey, since our aim is to include only experienced ETF investors in the ETF section.

Our survey is aimed at European investment professionals. Thus, the 163 respondents to the survey are based in Europe, a large part of which are from the UK, Switzerland and France (43% of the respondents). The exact breakdown of the respondents' country can be seen in Exhibit 3.1. We can see from these numbers that our sample gives a fair representation of the European investment market by geography.

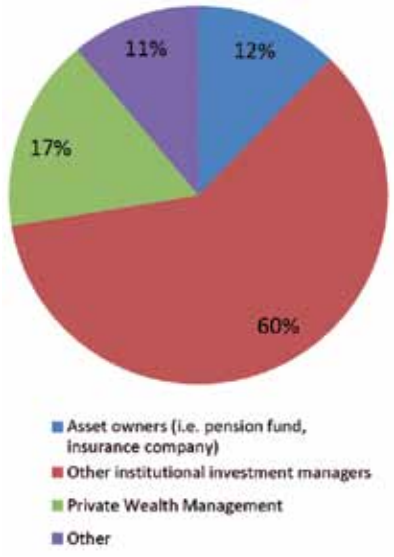
Exhibit 3.1: Country Distribution of Respondents
This exhibit indicates the percentage of respondents that have their activity in each of the mentioned countries. Percentages are based on the 163 replies to the survey.



3. Methodology and Data

We also asked participants about their institution's principal activity, allowing us to distinguish between professionals in institutional investment management and those in private wealth management. With 72% of the survey participants, institutional managers are the largest professional group represented in this study (the total of Asset Owners and Other Institutional Investors as shown in Exhibit 3.2). About 17% of respondents belong to the private wealth management industry. Finally, the remaining 11% is made up of other professionals within the financial services industry, such as investment bankers or industry representatives.

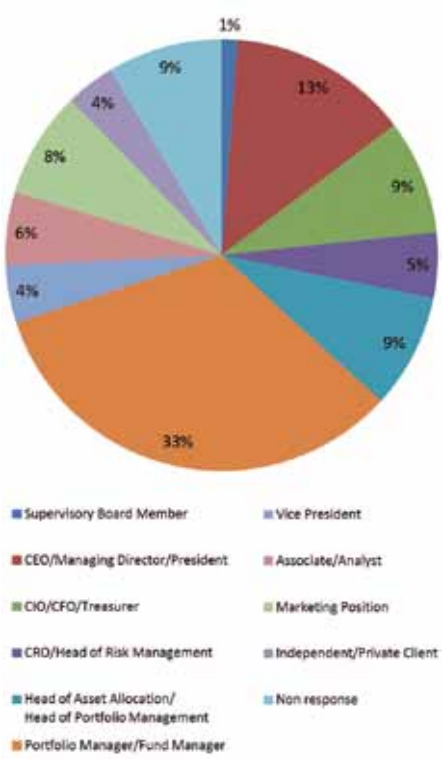
Exhibit 3.2: Main Activity of Respondents' Institution
This exhibit indicates the distribution of respondents according to their institution's principal activity. Percentages are based on the163 replies to the survey.



It is important to qualify respondents by their job function. In fact, we would expect that given the importance of choosing investment instruments such as ETFs or competing index products for investment organisations, it would be fairly high ranked executives or portfolio management specialists that would be most suited to answer our questionnaire.

Many of the respondents indeed occupy high-ranking positions: 15% are board members and CEOs, and 22% are directly responsible for the overall investments of their company (such as CIOs, CROs, or Heads of Portfolio Management). A third (33%) of the survey participants are portfolio or fund managers (see Exhibit 3.3).

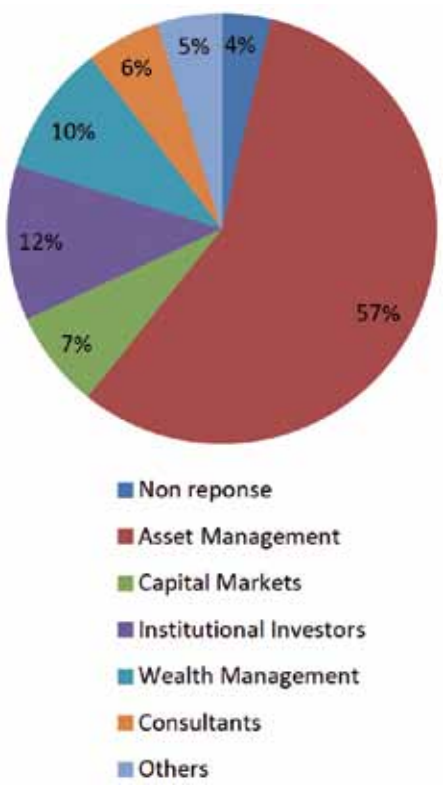
Exhibit 3.3: Function of Survey Respondents
This exhibit indicates the distribution of respondents based on their positions held in the company. Percentages are based on the 163 replies to the survey. Non-responses are reported as "no answer" so that the percentages for all categories add up to 100%.



We also ask the respondents about the nature of their activity. From Exhibit 3.4, we can see that more than half of the respondents (57%) are asset managers.

3. Methodology and Data

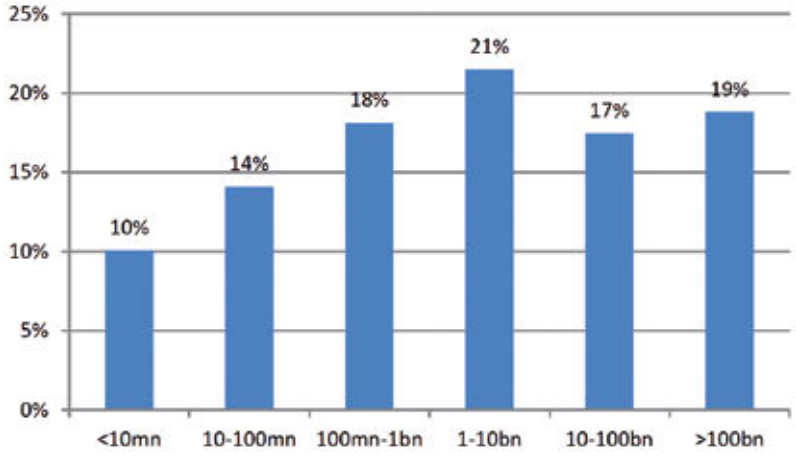
Exhibit 3.4: Nature of Survey Respondent Activity
This exhibit indicates the distribution of respondents based on the nature of their activity in the company. Percentages are based on the 163 replies to the survey. Non-responses are reported as "no answer" so that the percentages for all categories add up to 100%.



Finally, Exhibit 3.5 shows the AUM of the companies for which the survey respondents work. More than a third (36%) of the firms in the group of respondents are large firms that have over €10bn in AUM. Another two-fifths (40%) of respondents are from medium-sized companies, with AUM of between €100m and €10bn. We also capture the opinions of small firms, with about a quarter (24%) having AUM of less than €100m. This feature on the size breakdown implies that the European ETF and Smart Beta and Factor Investing Survey 2018 mainly reflects the views of medium- to large-sized companies, which account for 76% of the respondents.

Taken together, we believe that this regional diversity and fair balance of different asset management professionals make the survey largely representative of European ETF and smart beta strategy investors. After having described the sample that our survey is based on, we now turn to the analysis of the responses that we obtained from these survey participants.

Exhibit 3.5: Assets Under Management (in EUR)
This exhibit indicates the distribution of respondents based on the AUM which they reported. Percentages are based on the 163 replies to the survey, excluding non-responses.



4. Results

4. Results

In this section, we present the main results of this survey and discuss possible explanations for the respondents' answers. There are two main sections in this survey. In the first part, we take a close look at the use of and satisfaction with ETFs in practice. We also invite survey participants to express their views on future developments in the ETF market. Furthermore, we investigate the role ETFs play in asset allocation decisions, including the reasons for investing in ETFs. Finally, we compare the results of the ETF section of this year's survey to previous ETF surveys from 2006 to 2016 in order to get further insight into trends over time.

The second section is dedicated to smart beta strategies and factor investing. Respondents are asked to give their opinions about products that track smart beta indices, in relation to the recent considerable development in these types of indices. They were also asked about their current use of smart beta and factor investing solutions in their portfolio allocation, the difficulties they are facing and their needs in terms of further development in alternative equity beta strategies. This year, respondents were also asked about fixed-income smart beta. We also compare the results of this smart beta and factor investing section to previous results drawn from our surveys since 2013, which is when smart beta-related questions were first introduced.

4.1. ETFs

For a number of years now, ETF products have continue to gain increased attention. This first section is based on the answers given by 148 respondents from among our sample of 163 who invest in ETFs, and it allows us to highlight ETF perspectives from the investor viewpoint. Before that, we did, however, ask the additional 15 respondents the reason(s) why they do not invest in ETFs. From among these 15 respondents, 3 of them, representing 20% of the sample, indicated that they use instruments other than ETFs for the purposes of passive management, with two of them (13%) indicating that they preferred non-listed index funds or mandates, and one of them (7%) stating that he preferred futures), 6 of them, representing 40% of the sample gave various reasons for not using ETFs, mainly relating to organisational constraints. Finally, five of them (33% of respondents) do not use ETFs because they did not invest in passive management products and were exclusively active managers (see Exhibit 4.1). It is interesting to note that, the proportion of respondents that do not use ETFs is similar in 2018 to the one observed in 2016, after having being significantly higher in the previous editions of our ETF survey (e.g. 18% in 2015, 15% in 2014 and 16% in 2013), which leads us to believe that the proportion of investors that use ETFs has now reached a maximum level.

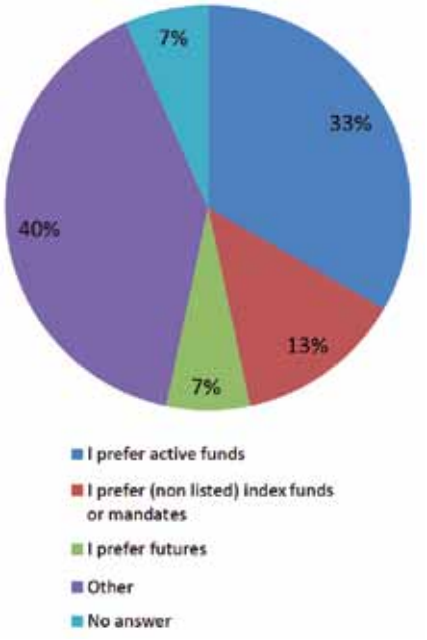
Compared to 2016, we have more active managers among those respondents that do not use ETFs, and fewer respondents that use other instruments for pasive management (see Exhibit 4.1.a).

In this section, we begin by analysing the use of ETFs in different asset classes, both in terms of the number of investors and in terms of the amount of investment; we then look at satisfaction with ETFs reported by investors. We equally look at the

4. Results

investment strategies used in the industry, as well as the criteria considered to select an ETF provider, including tracking error and cost. Additionally, survey participants were invited to express their views on the future developments in the ETF markets. Finally, we display the trends in the use of ETFs observed over the past twelve years.

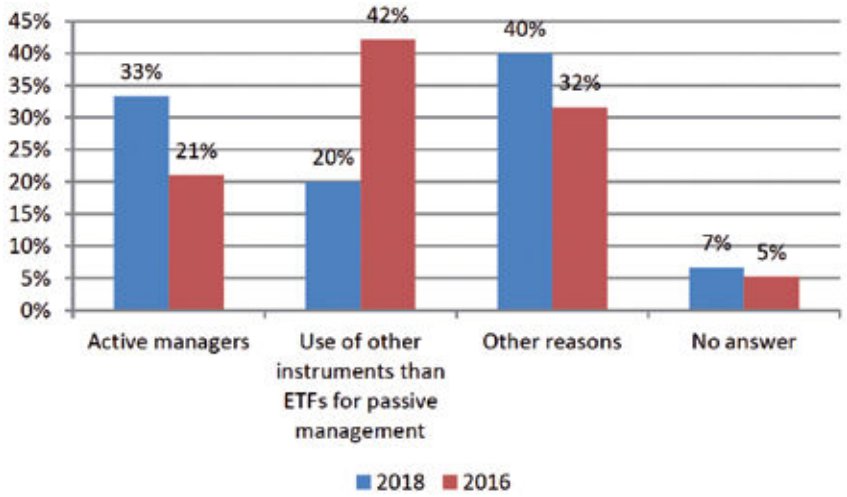
Exhibit 4.1: Motivations for not Investing in ETFs
This exhibit indicates the reasons given by respondents for not investing in ETFs. Percentages are based on the 15 survey respondents that do not invest in ETFs.



4.1.1. Use of ETFs in Different Asset Classes

First, we look into the relative importance attached to ETFs and other investment instruments in each asset class. Exhibit 4.2 summarises the use of ETFs or ETF-like products among investors who invest in the relevant asset classes. For instance, 92% and 81% of respondents have used ETFs or ETF-like products for their equity or sector investments, respectively. Meanwhile, 67% of respondents use ETFs to invest in smart beta and factor investing, which is similar to 2016. 66% and 62% of respondents use ETFs to invest in corporate and government bonds respectively. Compared to the high use of ETFs in the equity class, the use of ETFs to invest in bonds appears quite weak. Within alternative asset classes, four-fifths (80%) of investors who invest in commodities actually employ ETFs. Real estate ETFs are used by 45% of investors, while SRI and infrastructure ETFs are used by more than a third (37% and 35%, respectively) of investors who hold such assets. Volatility ETFs are used by a third (33%) of investors. Money market funds

Exhibit 4.1.a: Motivations for not Investing in ETFs
This exhibit compares the reasons given by respondents for not investing in ETFs to the ones given in 2016. Percentages are based on the 15 survey respondents that do not invest in ETFs.



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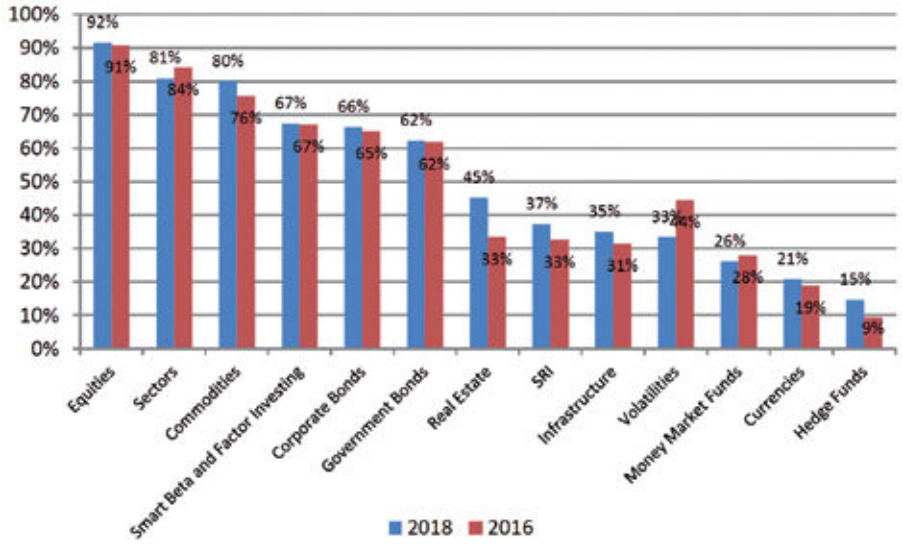
are used by about a quarter (26%) of investors. However, currencies (21%) and hedge funds (15%) are the asset classes in which the fewest investors have employed ETFs for their portfolios.

We observe a high stability between 2016 and 2018 in the percentage of respondents using ETFs for some asset classes, including equities, smart beta and factor investing, government bonds, corporate bonds and currencies). Alternatively, the percentage of respondents using ETFs is highly volatile for volatility and real asset classes from one year to another, with great differences observed in 2018, compared to 2016. So, we can see that – while ETFs are used across a wide spectrum of asset classes – the main use is in the area of equities, sectors and commodities. This is likely to be linked to the popularity of indexing in these asset classes as well as to the fact that equity indices, sector indices and commodity indices are based on highly liquid instruments, which makes it straightforward to create ETFs on such underlying securities. In addition, given that liquidity is one of the major benefits of an ETF, and that this is dependent on the liquidity of the underlying securities, it would make sense that ETFs based on the most liquid underlying securities are the most popular.

Concerning equity and bond classes, respondents were asked to detail the various categories of ETFs they invest in (see Exhibits 4.3 to 4.5). The vast majority of respondents invest in broad market ETFs (92% for equity investment, 74% and 79% for government bonds and corporate bonds, respectively). In addition, more than half of them also invest in sector ETFs for equity investments (54%) and in market segment ETFs (53%). A significant percentage of respondents invest in inflation-protected bond ETFs (47%) for government bond investments, and in credit rating segment ETFs (43%) for corporate bond investments. The use of style ETFs within the equity asset class is much lower (36%). This is also the case for the amount of respondents that use maturity-segment ETFs within the

Exhibit 4.2: Use of ETFs and ETF-like Products
This exhibit indicates the percentage of respondents that reported using ETFs or ETF-like products for asset classes/investment styles that they have already invested in/used. We also displayed 2016 results to show the evolution of results between the two years. The percentages have been normalised by excluding the non-responses.



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corporate bond asset class (31%). Lastly, only 19% of respondents use sector ETFs within the corporate bond asset class. While the results are quite similar to those obtained in 2016 for equity ETFs, we observe a decrease in all the categories of ETFs both for government and corporate bonds, with the exception of sector ETFs for corporate bonds for which a significant increase in the use is observed, with 19% of respondents using them in 2018, compared to 11% in 2016.

Exhibit 4.3: Categories of Equity ETFs Respondents Invest In
This exhibit indicates the categories of equity ETFs respondents invest in. The percentages are based on the sole respondents that invest in Equity ETFs. We also displayed 2016 results to show the evolution of results between the two years.

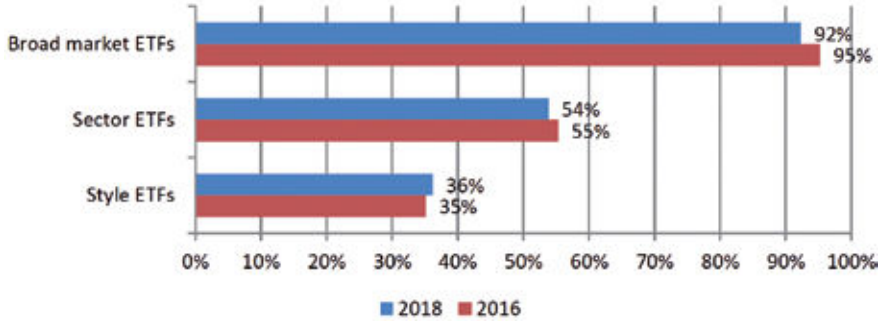


Exhibit 4.4: Categories of Government Bond ETFs investors invest in
This exhibit indicates the categories of government bond ETFs respondents invest in. The percentages are based on the sole respondents that invest in government bond ETFs. We also displayed 2016 results to show the evolution of results between the two years.

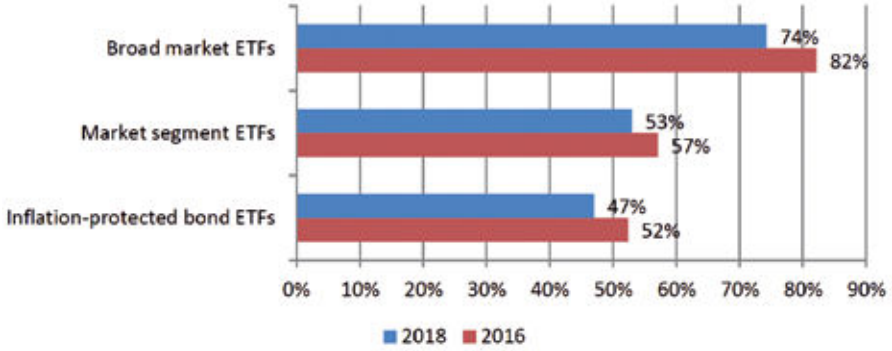
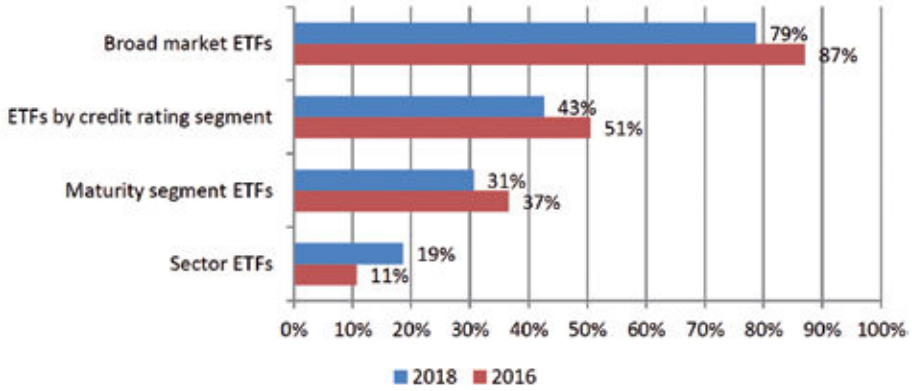


Exhibit 4.5: Categories of Corporate Bond ETFs investors invest in
This exhibit indicates the categories of corporate bond ETFs respondents invest in. The percentages are based on the sole respondents that invest in corporate bond ETFs. We also displayed 2016 results to show the evolution of results between the two years.



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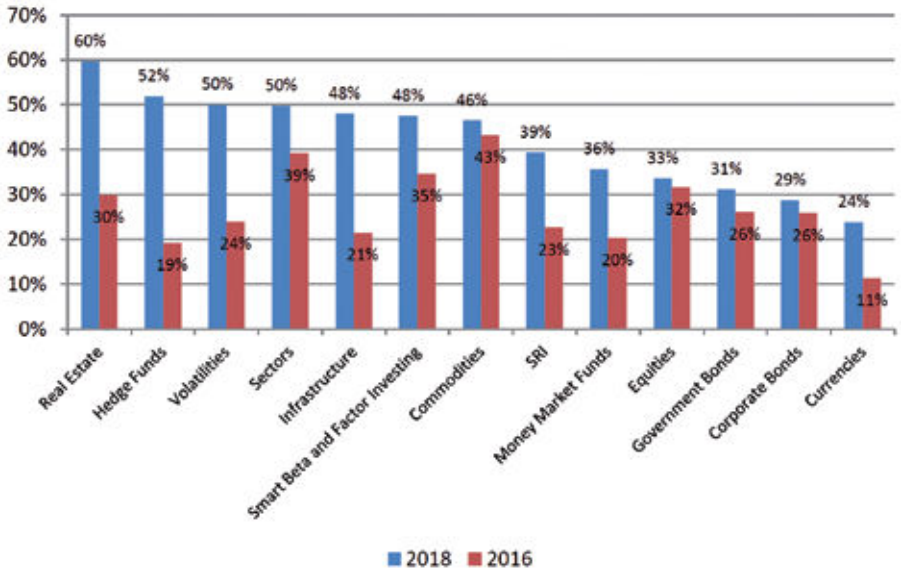
Thus, it appears from the three exhibits that, for both equities and bonds, investors use broad market ETFs much more frequently than ETFs based on finer market segments. This may possibly be explained by the fact that offerings on the finest segments are generally more recent, less known and less suited to the needs of investors.

To complement the results displayed in Exhibit 4.2, Exhibit 4.6 shows for each asset class, the percentages of the amounts invested that are accounted for by ETFs or ETF-like products. It differs from the questions asked in Exhibit 4.2, which shows the rate of ETF usage for those respondents who invest in the respective asset class/investment category. Here, Exhibit 4.6 reflects the intensity of usage for those investors who do use ETFs. It shows that ETFs account for a sizeable and increasing share, compared to 2016, of overall assets across different asset classes. This global increase is not surprising, as each year in our survey, a large share of respondents declare that they plan to increase their use of ETFs (see Exhibit 4.19 in Section 4.1.5).

Indeed, for the average respondent to this question, ETFs account for 60% or real estate investment, 52% for hedge funds investment, 50% of both volatilities and sector, 48% of both infrastructure and smart beta and factor investment, 46% of total commodities investment, 39% of SRI investment, 36% of money market fund investment, 33% of equity investment, 31% of government bond investment and 29% of corporate bond investment. The lowest share of investment in ETFs is for currencies with 24% invested via ETFs in their universe. So, the results of these two questions show that not only are ETFs widely used across most asset classes, but they also make up a significant proportion of investors' portfolios. This proportion is higher on average than the one declared last year for all asset classes.

Exhibit 4.6: The Percentage of Total Investment Accounted for by ETFs or ETF-like Products
This exhibit indicates the average percentage of total investment accounted for by ETFs or ETF-like products for each asset class. We only consider respondents that do use ETFs for the given asset class. Thus the percentage indicates the volume invested in ETFs compared to all investments in the asset class, for those respondents who do use ETFs. We also displayed 2016 results to show the evolution of results between the two years. The percentages have been normalised by excluding the non-responses.



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However, in the analysis of the results of this question, we have to separate the asset classes for which we have a significant number of respondents using ETFs, namely equities, corporate bonds, government bonds, commodities, sectors, and smart beta and factor investing, where the number of respondents range from 37 to 130, and the asset classes for which respondents using ETFs are less numerous, namely real estate, SRI, money market fund, currencies, volatility, infrastructure and hedge funds, where the number of respondents range from 6 to 23. It should be noted that, most of the highest increases are to be found in the later group, in which the answer of one respondent may have a more significant impact on the average results, than in the groups with more numerous respondents. For the asset classes where the number of respondents is more numerous, there is more stability in the results from one year to another (e.g. equities, government bonds, corporate bonds, commodities, with an increase of 1%, 5%, 3% and 3%, respectively). More interesting in this group, with more numerous respondents, are the significant increases observed for smart beta and factor investing, and sectors (13% et 11%, respectively).

4.1.2. Satisfaction with ETFs

We continue our analysis with a general assessment of the satisfaction of ETF products by asset class. Only those respondents who use ETFs in the respective asset class are asked to report their degree of satisfaction. This means that our results can be interpreted as the satisfaction rates of investors who actually have experience in using ETFs. Exhibit 4.7 shows that, across all asset classes, a large majority of users are satisfied with their ETFs. Satisfaction is remarkably high (more than 88%) for eight out of 13 asset classes, including sectors, equities, government bonds, money market funds, real estate, volatilities. corporate bonds, and SRI. This is particularly so for sectors and equities with a satisfaction rate of 100% and 97%, respectively. Infrastructure, commodities and smart beta and factor investing have quite good satisfaction levels around 70%. Currencies have a lower satisfaction level of 64%. The lowest level of satisfaction is obtained for the hedge fund classes, with only17% of users that are satisfied.

Compared to 2016, most of the satisfaction levels have encountered an increase, the exceptions being hedge funds, and in a lesser extend smart beta and factor investing, as well as commodities. The use and perception of smart beta and factor investing strategies will be fully developed in the second part of the result section of this survey. The largest increase in satisfaction is observed for volatilities and infrastructure, while the largest decrease is observed for hedge funds. For asset classes with a narrow sample of respondents using ETFs to invest in these asset classes, such as hedge funds, infrastructure and currency (6, 7 and 11 respondents, respectively in the 2018 survey), it is not surprising to observe a level of satisfaction quite volatile from one year to another. For example, similar to 2018, there were only six respondents who use ETFs to invest in the hedge fund asset class in 2016. Two of them declare to be satisfied with ETFs in 2016, to be compared with only one in 2018. The opinion of just one respondent is responsible for the significant variation

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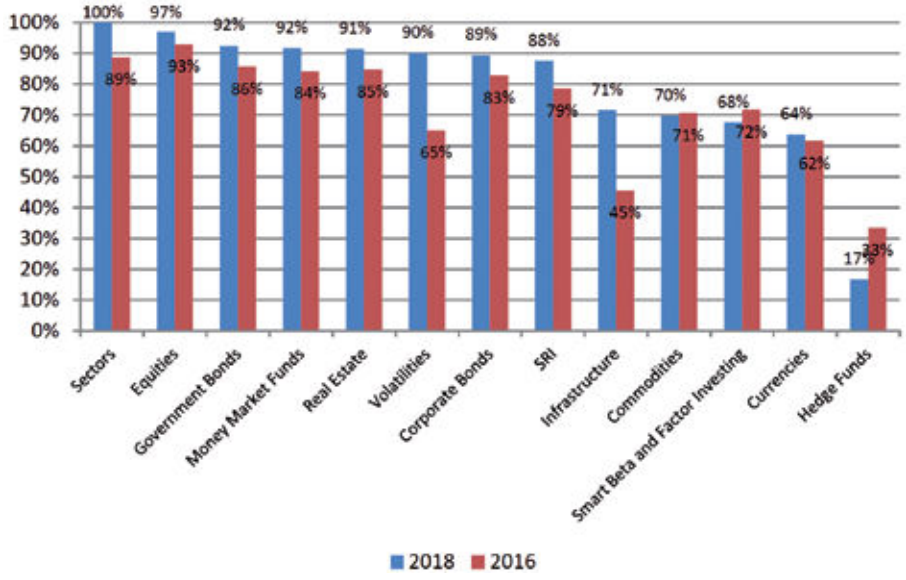
in the satisfaction rate. In the same way, there were 11 respondents who used ETFs to invest in infrastructure in 2016, versus only seven in 2018. There were five satisfied respondents for this asset class over the two years. It seems that most of the dissatisfied respondents of 2016 using ETFs for this asset class have disappeared from the sample. Similarly, in what concerns volatilities, there were 20 respondents using ETFs for this asset class in 2016, with 13 of them declaring to be satisfied. In 2018, there were only 10 respondents using ETFs for this asset class, but nine of them were satisfied.

The reasons for satisfaction or dissatisfaction may vary by asset class. Constructing truly representative indices in alternative asset classes may be a challenge, especially when doing so involves attempts to attain the investability which is necessary to construct an ETF where effective arbitrage can take place. There is often a trade-off between investability and representativity, with index providers limiting the constituents of hedge fund indices to be the most investable, but by excluding certain funds, representativity will be decreased. Another problem faced when constructing a representative index is that there is a lack of informational disclosure with regard to performance by a large number of hedge funds that should be part of the index due to a lack of regulation requiring such disclosures (Goltz, Martellini, and Vaissié, 2007.) Similar to issues with hedge fund indices, the construction of volatility indices also requires the presence of a liquid option market, which raises the challenge of enhancing the availability of the product range (Whaley, 2008; Goltz, Guobuzaite and Martellini, 2011). We notice that the ETFs with the highest and most consistent satisfaction rates over a period covered by our surveys are those based on the most liquid asset classes and we discuss this along with other time trends in Section 4.1.5.

Exhibit 4.7: If You Use ETFs or ETF-like Products, Are You Satisfied With Them?
This exhibit indicates the percentage of investors who are satisfied with ETFs or ETF-like products they have used for each asset class. The percentages have been normalised by excluding the non-responses. We also displayed 2016 results to show the evolution of results between the two years.



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It is interesting to note that volatility indices are among the asset classes for which we observe a great volatility with ETF satisfaction rates from one year to another. This may be related to the fact that they do not directly track a volatility index but a volatility futures index. This does not result in accurate exposure to the volatility index, whose changes in value can be quite different to those of the volatility futures index. This effect has been discussed in detail by Goltz and Stoyanov (2012). Commodity indices – an asset class for which the sample of respondents using ETFs is of a reasonable size – scored fourth lowest in terms of satisfaction rate. There are many different commodity indices (see Feldman, 2006; Dunsby and Nelson, 2010; Arnott et al., 2014), but no consensus on which is the best. If investors are not satisfied with commodity index construction rules, they will be less satisfied with ETFs based on those indices, compared to other asset classes.

Moreover, when it comes to alternative asset classes, it may not be easy to implement economically meaningful long-only exposures. In particular, while long-only (and thus easy-to-implement) exposure to standard asset classes such as stocks and bonds provides access to a number of well-documented risk premia (such as the equity risk premium for stocks, and the credit and term premium for bonds), many alternative asset classes do not necessarily give access to risk premia through long-only investing. For example, it has been argued that long/short positions in commodity futures are necessary to capture risk premia in commodity markets while long-only exposure to commodity prices is not expected to give rise to any risk premium (see for example Fuertes, Miffre and Fernandez-Perez, 2013).

4.1.3. The Role of ETFs in the Asset Allocation Process

As ETFs offer investors attractive benefits like liquidity, cost efficiency and product variety, they have become an important instrument for asset allocation strategies. In this section, we analyse the purpose of ETF investments. In fact, one of the unique benefits of conducting a survey of ETF users is that we not only get information on the frequency and intensity of usage, but we are also able to inquire about the purposes for which ETFs are used and how their role in asset allocation is perceived.

We begin the analysis with the investors' rationales behind their use of ETF products. Investment in ETFs may be more of long-term or short-term nature. Also, when using ETFs, investors may aim to gain broad market exposure or, alternatively, to gain access to specific segments of the market through ETFs on sectors or styles. Beyond such a broad categorisation of use, we also assess how often ETFs are used for specific purposes such as neutralising factor exposures or arbitraging related assets. More specifically, we ask how often the survey participants employ ETFs for different investment purposes on a scale from never (score 0) to always (score 6). Exhibit 4.8 shows the answers by classifying all respondents into two groups: If respondents rated their usage to be 3 or less, we group them into rare users, otherwise into frequent users.

The results show that 71% of respondents use ETFs frequently for achieving broad

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market exposure. 61% of respondents use ETFs for buy-and-hold investments. Half of respondents use them for short-term (dynamic) investments, while 45% of respondents use them for tactical bets or to obtain specific sub-segment exposure. ETFs are less frequently used to manage cash flows (17%), for dynamic portfolio insurance strategies (11%), to neutralise factor exposures related to other investments (9%), to capture arbitrage opportunities (6%) or tax advantages (4%).

These results show that investment in ETFs is mainly associated with a long-term exposure to broad market indices. Still, frequent use for market sub-segments exposure, as well as for tactical bets or for short-term exposure in this year's findings indicates that other investment purposes are important as well. This is not a surprising result given that the liquidity, low cost and product variety benefits of ETFs should make them viable tools for such purposes.

Respondents were then asked to give some insight on the important criteria they look when selecting an ETF provider. Respondents were proposed a list of criteria, including broadness of the range, quality of replication, innovation, costs, as a complement with an active offering of the provider, and long-term commitment of the provider. The results are displayed in Exhibit 4.9. There are especially two criteria that come first in respondent motivations to select an ETF provider. The first one is costs, with a vast majority of 89% of respondents mentioning it. The second one is the quality of replication, with more than four-fifths of respondents (83%) considering this criterion when selecting an ETF provider. This result is not surprising as these two criteria are related to the main motivations for using ETFs, namely reducing investment costs, while tracking the performance of the underlying index in the best way. With 41% and 38% of respondents, respectively, long-term commitment of the provider and broadness of the range are also two criteria that are quite important for respondents when choosing an ETF

Exhibit 4.8: How Often Do You Use ETFs for the Following Purposes?
This exhibit indicates the frequency of respondents using ETFs for each of the mentioned purposes. Respondents were asked to rate the frequency from 1 to 6. The "frequent" category would include ratings from 4 to 6 and "Rarely" would take into account ratings from 1 to 3 and non-responses.

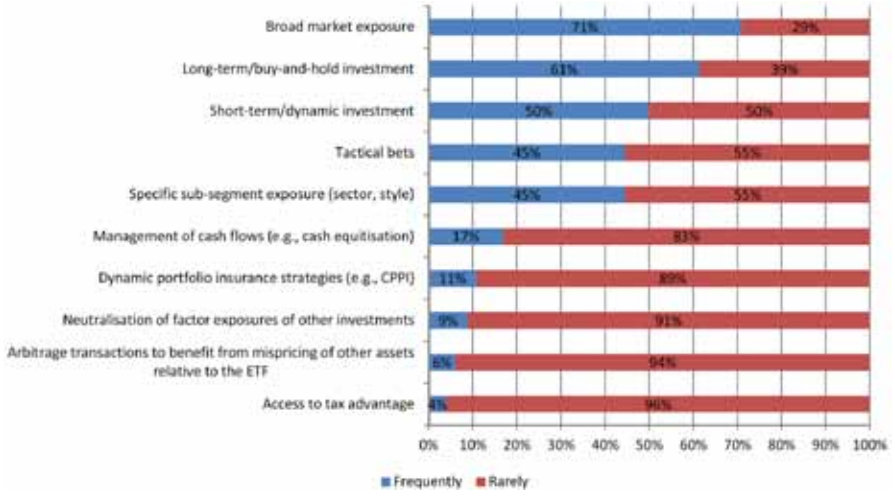

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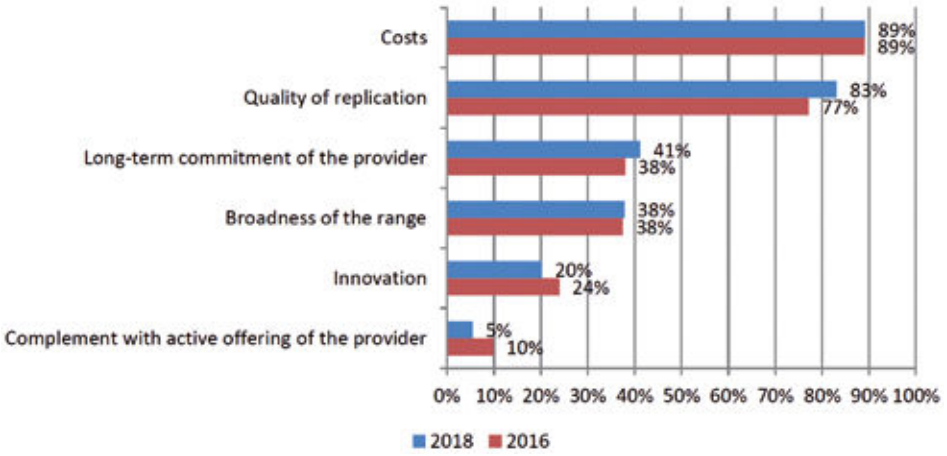
Exhibit 4.9 What Criteria Do You Consider When Selecting an ETF Provider?
This exhibit indicates the criteria respondents look when selecting an ETF provider. More than one response can be given. We also displayed 2016 results to show the evolution of results between the two years.



provider. With only 20% of respondents mentioning it, innovation seems less important for respondents. Finally, 5% of respondents consider it important to select an ETF as a complement with the active offering of a provider. If the results are quite comparable with those obtained in 2016, the trend has been to an increase in the importance of the criteria already placed at the top of the list in 2016, and a slight decline in the criteria that were at the bottom of the list.

Cost is a critical factor that affects portfolio performance. It is a general quality for all types of investment, and under more pressure as the industry becomes more competitive. Whenever an investor considers a product, the cost is always an important question which may determine the choice of investment. According to Carhart (1997), the common factors in stock returns and the differences in both mutual fund expenses and transaction costs almost entirely explain the persistence of mutual fund returns. So, aside from the underlying index being tracked by the ETF (which will determine exposure to common factors) the level of fund expenses is an important determinant of performance. French (2008) also illustrates the importance of cost in relation to investment performance by showing that the effect of U.S. investors switching from an active to a passive investment strategy with lower costs, between 1980 and 2006, would result in an increase of average annual returns by 67 basis points.

ETF costs include the total expense ratio (TER), as well as cost of liquidity, and brokerage fees. The TER, which includes management fees, is a cost that will erode the NAV of the ETF over time and is unrelated to the trading activity, as opposed to brokerage fees which, when aggregated, will be related to the volume of trading that takes place. The present result shows that respondents are strongly scrutinising costs within ETFs, even though they are already a comparatively low-cost vehicle. This may be seen as a result of the recent focus that has been placed on the 'hidden costs' that investors are being charged relating to securities lending fees by the regulators.

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The primary goal of an ETF is to track the performance of an underlying index, explaining why the quality of replication is very important for investors. The tracking quality of ETFs may be characterised by several indicators, including not only the tracking error but also the tracking difference. The tracking difference is the difference between ETF total return and the total return of the replicated index, while the tracking error evaluates the volatility of the difference in return between an ETF and its benchmark. Bonelli (2015) shows that depending on whether we consider the level of tracking error or the level of tracking difference, the ranking of ETFs that track the same index may differ greatly. For example, considering a collection of five ETFs that track the MSCI World Index, he observes that tracking error varies significantly across the different ETFs that track the same index (from 0.02% to 0.22%). The ETF with the lowest tracking error relative to the index has one of the highest tracking differences (-0.42%), and thus greatly underperforms its benchmark, while an ETF with one of the highest tracking errors (0.21%) also has the lowest tracking difference (-0.19%). Similar results were obtained for two other indices, namely the MSCI Emerging Markets Index and the MSCI Europe Euro Index. Bonelli (2015) concludes that tracking error is not representative of the under- or outperformance of ETFs with respect to their benchmark, but serves first of all to evaluate the relative risk of daily deviations, and it is more a concern for short-term investors than for their mid-term or long-term counterparts. Long-term investors may be more interested in tracking difference, as its level provides information about ETF costs. Indeed, if ETF replication were perfect, the tracking difference would be equal to the ETF expense ratio. Thus, the lower the tracking difference, the lower the expense ratio.

4.1.4. Future Development of ETFs

So far, our questions have focused mainly on the current usage of ETFs. A clear advantage of our survey methodology (where we have access to a sample of investment management professionals) is that we can also analyse the plans for the future rather than just observe realisations. Thus, in a last set of questions in this section on ETFs, we offer a glimpse into the future by asking survey participants about their views on their use of ETFs in the future. This allows us to gain some perspective on future developments on the demand side of the ETF industry.

First, we try to define a bit more clearly the type of niche markets where investors would like to see further product development. Since 2000, the industry has become more mature and there are over 1,600 ETFs in the European market (ETFGI, 2017), hence it will be very interesting to see where the gaps in the market are in terms of investor demand. Exhibit 4.10 illustrates the types of ETFs that respondents would like to see further developed in the future. Respondents were given the option of selecting more than one answer.

As shown in Exhibit 4.10, Ethical/SRI ETFs (34%) are the top concern of respondents. Just behind are ETFs based on emerging markets equity and emerging market bond ETFs, with 32% and 31% of respondents, respectively. Just after came ETFs based

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on smart beta indices, ETFs based on multi-factor, and ETFs based on smart bond indices, with 27%, 25% and 23% of respondents, respectively. This indicates strong interest in alternative indices. Alternative indices include those that are equally weighted or based on fundamental company characteristics (see Arnott, Hsu and Moore, 2005, or Amenc, Goltz and Le Sourd, 2009, for an introduction to such weighting schemes), or on weights derived from portfolio optimisation (see e.g. Amenc et al., 2010). This latter result is interesting as there have been a considerable number of product launches in the area of smart beta ETFs (see Section 2.2 of this document for some background on smart beta strategies and factor investing). The fact that a quarter of investors still see room for further product development may be explained by the fact that product launches have focused on relatively few popular strategies representing a small number of risk premia such as the value premium and defensive equity strategies. Indeed, the first generation of smart beta benchmarks were embedded solutions which did not distinguish the stock picking methodology from the weighting methodology. As such, they obliged the investor to be exposed to particular systematic risks which represented the very source of their performance (see Amenc, Goltz and Martellini, 2013). Given the increasing discussion on harnessing multiple factor premia from equity investing, including factors such as momentum, size, and quality, among others, it is perhaps not surprising that investors still see room for further product development. In addition, the arrival of the Smart Beta 2.0 offers yet

Exhibit 4.10: What Type of ETF Products Would You Like to See Developed Further in the Future?
This exhibit indicates the percentage of respondents who would like to see further development in the future for different ETF products. Respondents were able to choose more than one product.

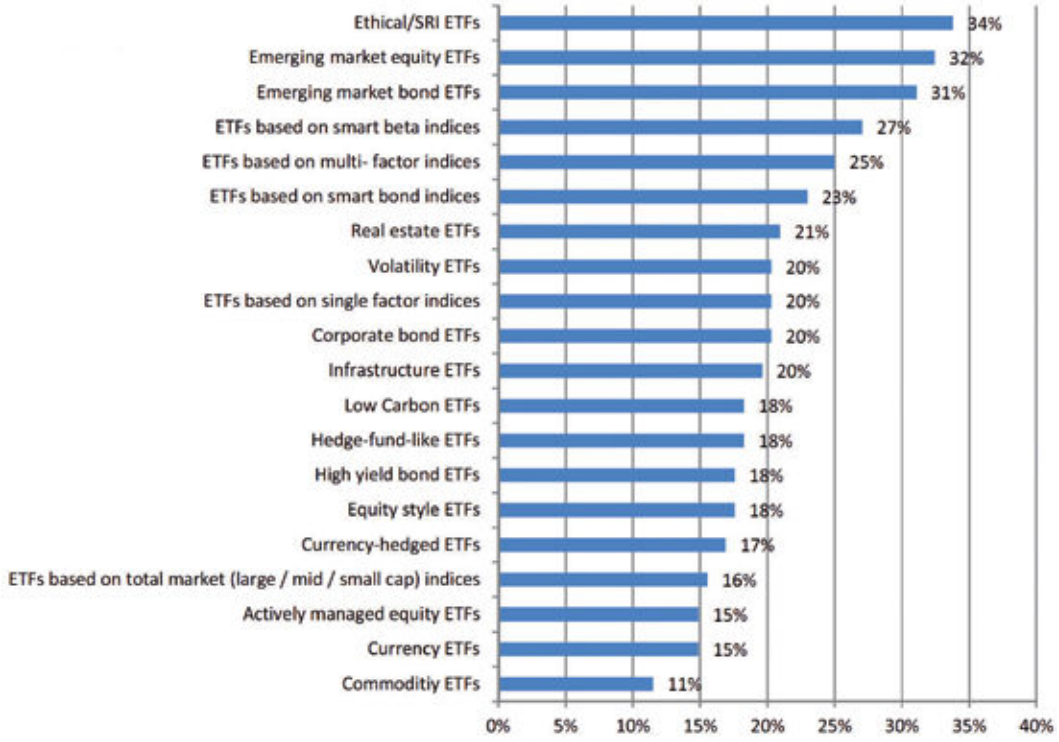

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Exhibit 4.11: Largest increases in demand for product development in 2018
This exhibit shows the types of ETFs for which there were increases in terms of demand for future product development between 2016 and 2018, ranked in decreasing order of percentage increase.

What type of ETF products would you like to see developed further in the future?	2016	2018	% Increase
Ethical/SRI ETFs	27.6%	33.8%	6.2%
Emerging market bond ETFs	26.6%	31.1%	4.5%
Real estate ETFs	17.7%	20.9%	3.2%
Low Carbon ETFs	17.2%	18.2%	1.1%
Corporate bond ETFs	19.3%	20.3%	1.0%
Actively-managed equity ETFs	14.1%	14.9%	0.8%

increased investor interest for this type of product. The Smart Beta 2.0 approach enables investors to explicitly choose exposure to systematic risk factors, as well as to choose the weighting scheme of the smart beta benchmark (see Amenc, Goltz and Martellini, 2013). Further questions on smart beta and factor investing strategies are presented in Section 4.2 of this document.

Real estate ETFs, volatility ETFs, ETFs based on single-factor indices, corporate bond ETFs and infrastructure ETFs, are also in the top half of the list of respondent further demands, with 21% of respondents choosing real estate ETFs, and 20% of them choosing the other four categories.

Compared to last year's results, there has been an increase in the demand for product development within six categories of ETFs, namely Ethical/SRI, emerging market bond, real estate, low carbon, corporate bonds and actively-managed equity (see Exhibit 4.11). It is interesting to note that four of these categories, including Ethical/SRI, low carbon, actively-managed equity and emerging bond, have already seen an increase in respondent demands between 2015 and 2016, quite important for the first three. The decrease in demand for other categories of ETFs may be the result of increased satisfaction with products already developed within these areas in recent years. This may be the case for ETFs based on single-factor indices, or ETFs based on multi-factor indices.

Despite a decrease in demand, smart beta indices still remain in the four first categories of most interest to respondents in terms of product development. Additional results that are fully dedicated to smart beta and factor investing strategies will be developed in the second part of this survey. The Ethical/SRI category is at the top of the list for the first time, showing more and more concerns of respondents for this category of investment. We can also note the progression of further demands for low carbon ETFs, from one year to another, since we first introduce it in the propositions in 2015, even if this category is still in the second half of the list.

After establishing priorities for new ETF product development, we then asked respondents to comment on how they planned their future use of ETFs. From Exhibit 4.12 we can see that about half of respondents (50%, compared to 63% in 2016) report that they expect to

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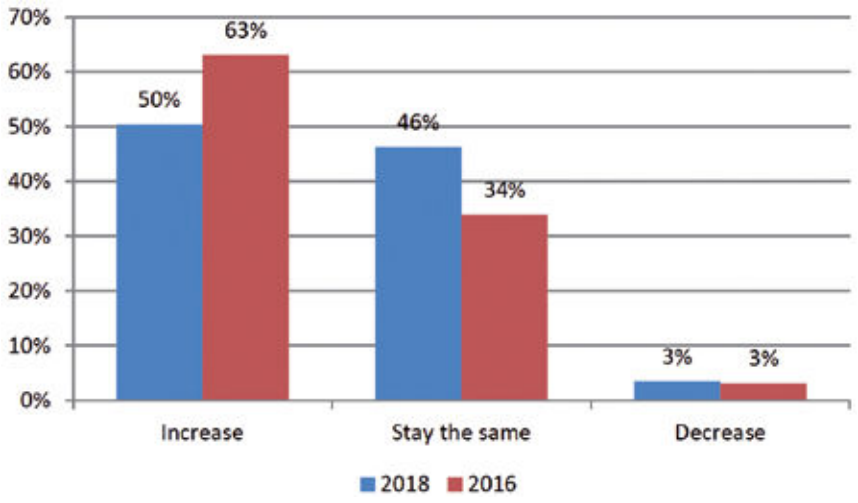
increase their use of ETFs. Less than half of them (46%, compared to 34% in 2016) indicated that their use of ETFs would stay the same. By summing the percentage of respondents who answered "Increase" or "Stay the same", we have a total of 97% of respondents, meaning that only 3% of respondents plan to decrease their use of ETFs. While there has been a significant drop in the number of respondents thinking of increasing the share of their investment in ETFs, this is probably that a growing number of respondents have reached a level of investment in ETFs that suits them. Consequently, the percentage of those who think of reducing their investment in ETFS remains stable and quite low since years (further details on the trend over years will be provided in Section 4.1.5 on Exhibit 4.19).

In addition, respondents who declared that they planned to increase their use of ETFs were also asked about their motivations for planning such an increase (the results are displayed in Exhibit 4.13). It appears that increasing the use of ETFs will serve as a substitute to the use of active managers for a vast majority of respondents (68% versus 70% in 2016), while 49% (versus 45% in 2016) of them will substitute them in favour of other index products. These results are quite comparable with those obtained in 2016. Comparisons with previous years are to be found in Exhibit 4.20 in Section 4.1.5, which displays trends over years.

These results should be associated with the disappointing performance of active management. Many academic papers were dedicated to analysing of the ability of active management to deliver positive alpha and persistent performance. Among the recent studies, Barras, Scaillet and Wermers (2010), covering the period 1975 to 2006, found that more than 75% of actively-managed US equity funds delivered a null performance after taking into account trading costs and expenses. Furthermore, 24% of the funds delivered negative alpha, while only 0.6% of them attained positive alpha after deducting fees. In addition, the authors noted a large decrease in the proportion of skilful managers over the past 20 years, with

Exhibit 4.12: How Do You Predict Your Future Use of ETFs?
This exhibit indicates the respondents' forecasts about their future use of ETFs. We also displayed 2016 results to show the evolution of results between the two years. Non- responses are excluded.



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14.4% of funds generating positive alphas in early 1990, compared with only 0.6% in late 2006. At the same time, an increase in the number of active funds generating negative alphas was observed, from 9.2% to 24.0%. In the same way, over the period from 1984 to 2006, Fama and French (2010) show that few active funds are able to produce returns high enough to compensate management fees.

In this context, investors may see the use of ETFs as more profitable and less costly than the use of active managers. ETFs allow investors to mimic the performance of all types of asset classes, including various smart beta and factor investing products, while limiting costs. Indeed, investors are now offered a wide range of smart beta ETFs with the promise of achieving performance at lower costs compared to active management (Osterland, 2015).[63]

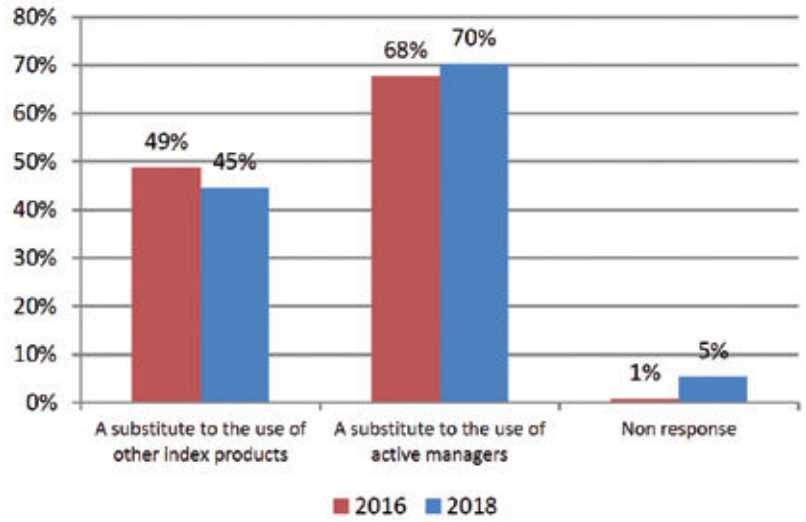
63 - http://www.cnbc.com/2015/10/06/smart-beta-and-stupid-fund-tricks.html

This hypothesis is confirmed as survey respondents declare that this replacement will first of all be motivated by costs for a vast majority of them (86%, versus 87% in 2016). The second motivation given by respondents is performance (51% of them, versus 58% in 2016); liquidity comes after with 42% of respondents (versus 55% in 2016). Finally, 34% of respondents (versus 47% in 2016) cite transparency as a motivation. These results confirm those of last year, in terms of relative importance for the various occurrences. However, if results are quite similar than in 2016 for costs, the other three motivations for choosing ETFs have encountered a decrease rather limited in what concerns performance, but more pronounced for transparency (see Exhibit 4.14). Comparisons with previous years are to be found in Exhibit 4.21, which displays the trends over the years.

In a recent paper, Malkiel (2013) argues that a considerable increase has been observed in the costs of active management in the United States over the period from 1980 to 2011. However, it appears that the fees charged by active funds were not compensated by higher performance for active funds than for passive funds.

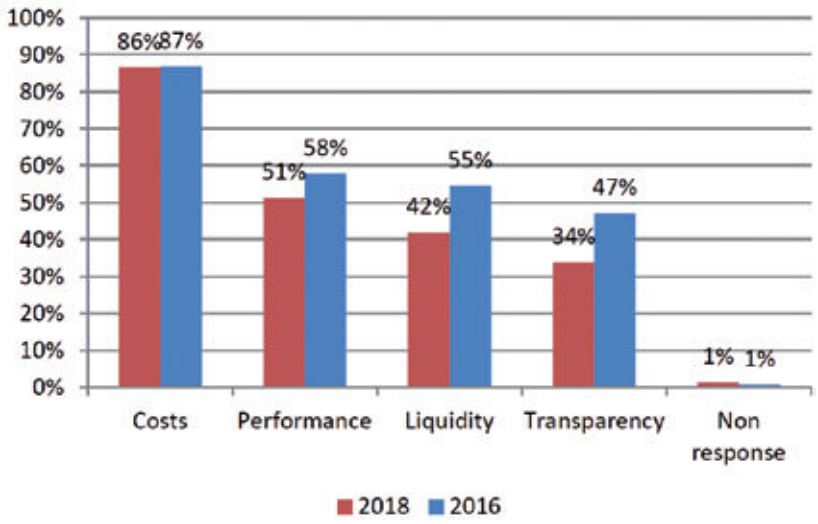
Rather, the level of underperformance

Exhibit 4.13: Increase in the Use of ETFs Will Serve As...
This exhibit indicates the reasons given by respondents for planning to increase their use of ETFs. More than one response could be given. We also displayed 2016 results to show the evolution of results between the two years.



4. Results

Exhibit 4.14: Increase in the use of ETFs will be motivated by...
This exhibit indicates the motivations given by respondents for planning to increase their use of ETFs. More than one response could be given. We also displayed 2016 results to show the evolution of results between the two years.



of active funds relative to passive funds was largely equal to the difference in fees between active and passive funds. Any increase in costs is thus perceived as a further loss of performance for investors. In view of our survey results, it is possible that the preference for ETFs shown by investors (who perceive them as low-cost tools and who have a tendency to replace active funds with ETFs) constitutes a coherent response to the increase of fees in the management industry as described by Malkiel (2013). This is all the more likely given that the leading reason investors give as a motivation for increasing ETF use is cost (see Exhibit 4.14). Investors now seem to be well aware of the effects of costs on long-term performance.

4.1.5. Trends: Use of and Satisfaction with ETFs over Time

Over the past decade, investment in ETFs has increased significantly, as already shown in Section 2.1. However, since ETFs are still a rather new class of financial products, all benefits and possible uses are not yet fully known to all potential investors. So, not only is the investment in standard ETFs growing, but so are more advanced products and sophisticated ways of using them. In this section, we compare the results of the ETF section of the ETF and Smart Beta and Factor Investing Survey 2018 with the answers we obtained in previous ETF surveys taken in 2006, and from 2008 to 2016. This comparison will shed some light on how the current state of ETF usage compares to past years and will provide some insight into the evolution of ETF usage to today.

Use of ETFs

When comparing the usage of ETFs and ETF-like products over time, we observe a sign of increasing propagation of their adoption over the past twelve years. The usage of ETFs and ETF-like products in Exhibit 4.15 refers to the number of respondents who use ETFs among all respondents who invest in a particular asset class. In other words, it is the frequency of the usage. Since 2006, the increase of the percentage of respondents using ETFs in traditional asset classes has

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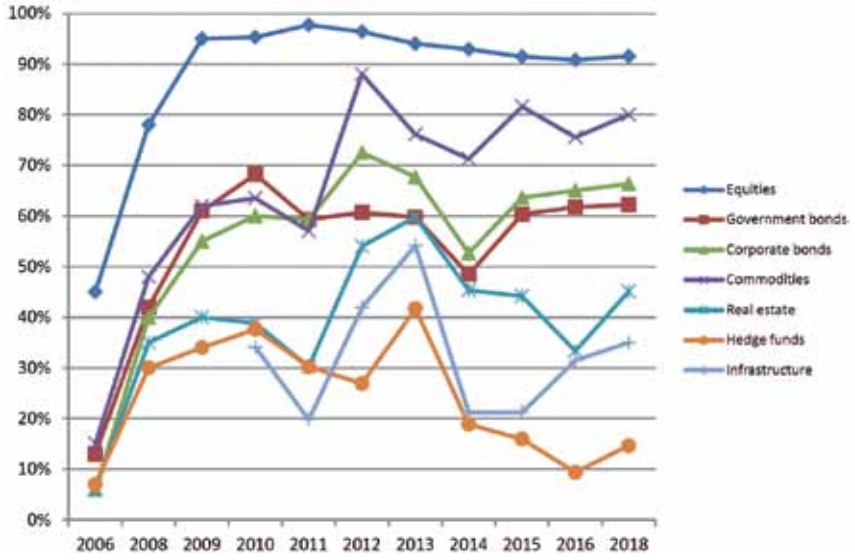
been spectacular. In 2006, the rate of use was under 20% for six out of seven asset classes and none of the asset class reached the 50% level of ETF use. At that time, 45% of respondents used ETFs to invest in equities, compared with 92% in 2018. As for governments and corporate bonds, the result went from 13% and 6% in 2006, to 62% and 66%, respectively, in 2018. A dramatic increase from 15% of respondents in 2006 to 80% in 2018 was also observed for commodities, while the share of respondents using ETFs to invest in real estate evolved from 6% in 2006 to 45% in 2018.

After a slight increase in the use of ETFs for investing in bond asset classes between 2015 and 2016, both for government and corporate bonds, we observe another slight increase this year for corporate bonds compared to 2018, and a stabilisation for government bonds. In 2016, 62% and 65% of respondents used ETFs to invest in government and corporate bonds, respectively, compared with 62% and 66% of respondents in 2018. This stability at a quite high threshold in ETF use for investing in bond asset classes is likely related to the high level of satisfaction observed over several years, with government bonds enjoying a satisfaction rate of around 90% since 2012, and corporate bonds enjoying a satisfaction rate ranging from 80% to 90% since 2011 (see Exhibit 4.17). With 80% of respondents using ETFs, commodities show an increase of 4 points compared to 2018. This slight increase follows a slight decrease observed between 2015 and 2016, so that the percentage of ETF users remains quite comparable to the one observed in 2015 and rather stable over the last three years. The equity class showed quite a stable rate in the use of ETFs for some years, above 90%. Other asset classes, such as real estate, infrastructure or hedge funds, exhibit larger variations in their rate of use over time compared to other asset classes. This year we observe an increase in the use of ETFs for the three asset classes, compared

Exhibit 4.15: Use of ETFs or ETF-like Products Over Time
This exhibit indicates the use of ETFs or ETF-like products for different asset classes over time. The percentages are based on the results of the EDHEC ETF survey in 2006, and from 2008 to 2018.



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to 2016. This increase is quite moderate for the infrastructure asset classes, with 35% of respondents using ETFs in 2018, compared to 31% in 2016. The hedge fund and real estate asset classes experienced a larger increase in the use of ETFs from 9% and 33%, respectively, in 2016 to 15% and 45%, respectively, in 2018. It appears that (with the exception of real estate, infrastructure and hedge funds) all rates of use are quite high, above 60%. It should be noted that, in Exhibit 4.15, we only present the asset classes for which we have data since at least 2009; other asset classes (including volatilities, sectors, SRI, Money market funds, currencies and smart beta) were introduced into our survey more recently.

Exhibit 4.16 compares the fraction of our respondents' portfolios that is invested in ETFs.[64] So, in Exhibit 4.16, the usage of ETFs or ETF-like products refers to the density of usage in each asset class. While the equity asset class is the one most widely used for ETF investment by investors, it is currently not the asset class with the highest proportion or density of ETF investment. In 2008, 22% of the investment in the equity asset class was made using ETFs, compared to 33% in 2018. As for government and corporate bonds, the increase in the proportion of ETF investment is more spectacular, having respectively accounted for 10% and 7% of total investment in 2008, compared to 31% and 29%, respectively, in 2018. The increase in the use of ETFs to invest in commodities and real estate has also been particularly significant during this period, with the former having 16% of total investment accounted for by ETFs in 2008, compared to 46% in 2018; as for real estate, in 2008 it had 7% of total investment accounted for by ETFs, compared to 60% in 2018. If we also see a strong increase in the use of ETFs for the hedge fund and infrastructure classes between the beginning of the period of observation and 2018, it should be noted that there can be many variations from one year to another, due to a narrow size of the sample of respondents using ETFs for these asset classes.

In 2018, we observe that all asset classes have noted an increase in their ETF market share, compared to 2016. This increase is slight or moderate for equities, corporate bonds, commodities and government bonds (1%, 3%, 3% and 5%, respectively). If we consider that this moderate increase followed a decrease in the same range observed in 2016 for the three later asset classes, it appears that ETF market share has been quite stable for the equity, government bond, corporate bond and commodity asset classes for some years, suggesting that users have reached a satisfactory level of ETF usage for these asset classes and are not looking to expand beyond this level. The increase is much higher for the three other asset classes, namely hedge funds (33%), real estate (30%) and infrastructure (27%). If we have been used to large variations from one year to another along the period for these three asset classes, such percentage of use have never been reached until now for real estate and hedge fund asset classes, but as mentioned above, the sample size of respondents using ETFs for the hedge fund asset class is especially small.

64 -Since this question was not asked in the EDHEC European ETF Survey 2006, we can only provide a comparison with answers from 2008 to 2016.

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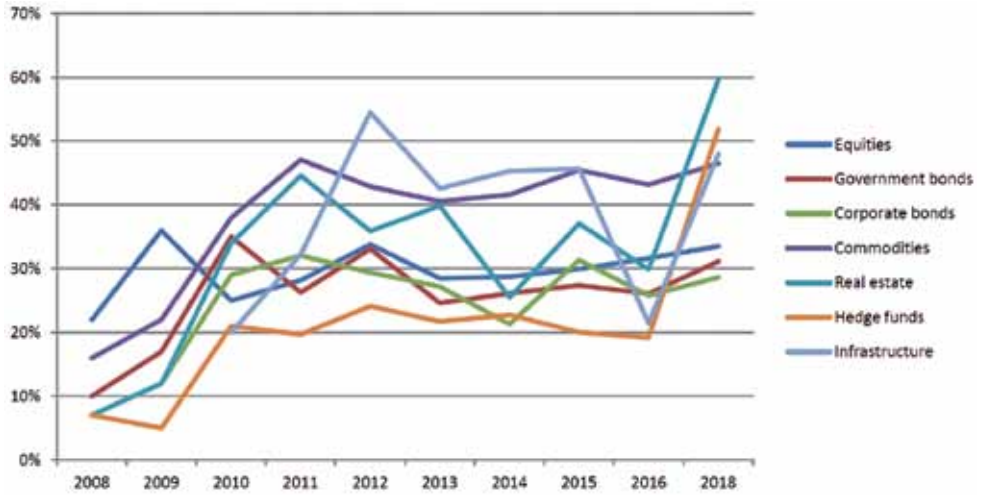
Exhibit 4.16: Percentage of Total Investment Accounted for by ETFs or ETF-like Products
This exhibit indicates the percentage of total investment accounted for by ETFs or ETF-like products for different asset classes over time. The percentages are based on the results of the EDHEC ETF survey from 2008 to 2018.



Satisfaction with ETFs

Satisfaction with standard ETFs has generally remained at high levels as shown in Exhibit 4.17. Compared to 2016, four out of seven asset classes exhibit moderate increases in the satisfaction rate. We observe a 4% increase in satisfaction with equity ETFs, which reaches the level of 97%, the highest satisfaction rate among all the asset classes. The high rate of equity ETF satisfaction, which has consistently been in the region of 90% since our first survey in 2006, may be due to the greater consensus for equity indices. Equity indices have the longest history of development and the most number of innovations, which consequently carries over to equity ETFs. Investors are therefore more familiar with equity indices as well as their drawbacks. Given the large variety of alternative weighting schemes for equity indices, investors have a wide range of products to invest in. Government bonds, corporate bonds and real estate asset classes have also encountered an increase in satisfaction in terms of ETF use of 6% for all three and are also among the classes with the highest level of satisfactions ranging around 90% in 2018.

The commodity asset class, which has seen an increase in the level of ETF satisfaction in 2016, exhibits a 1% decrease in satisfaction compared to 2016 to reach a level of satisfaction of 70%, at a rather stable level since 2014. Hedge fund assets exhibits a large decrease in satisfaction of 16% with ETFs compared to last year. With 17% of respondents satisfied with ETFs, it is its lowest value since 2006, and also the lowest satisfaction rate among the seven assets classes displayed in Exhibit 4.17. Finally, such as spectacular as the decrease in satisfaction rate observed for hedge fund ETFs, is the increase of 26% of infrastructure ETFs satisfaction rate, which reaches the level of 71%, which is however not its maximum value over the period, which was observed in 2014 and 2015 (86%). If this result is correlated with the increase in the market share for infrastructure ETFs displayed in Exhibit 4.16, we observe the inverse correlation for hedge fund ETFs.

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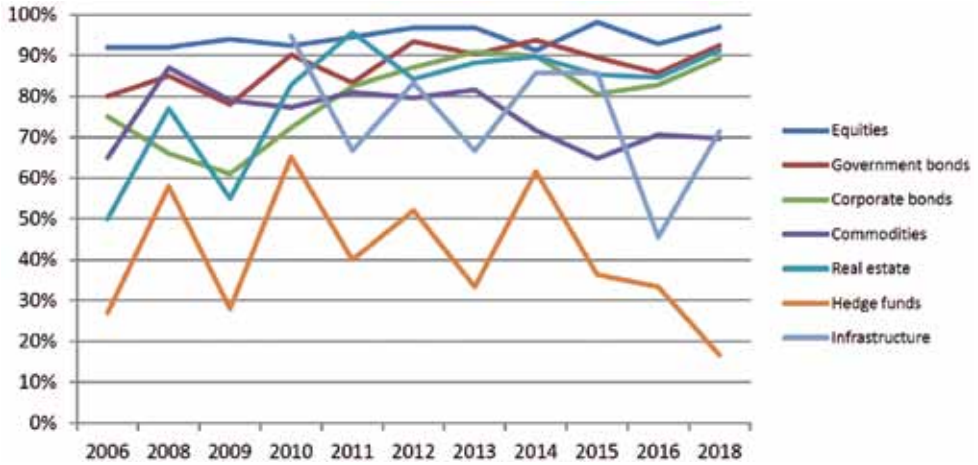
Exhibit 4.17: Satisfaction With ETFs or ETF-like Products Over Time
This exhibit indicates the percentages of respondents that are satisfied with ETFs or ETF-like products for different asset classes over time. The percentages are based on the results of the EDHEC ETF survey in 2006, and from 2008 to 2018.



Since the beginning of our period of observation, the satisfaction rates for hedge fund and infrastructure ETFs have been the two most volatile. It clearly seems that the less liquid and less mature ETF markets experience the most varying levels of satisfaction. The rate of satisfaction for hedge fund ETFs clearly displays a saw tooth shape, with high figures in 2008, 2010, 2012 and 2014 (58%, 65%, 52% and 62%, respectively) and lower figures in 2006, 2009, 2011, 2013, 2015, 2016, and 2018 (27%, 28%, 40%, 33%, 36%, 33%, and 17%, respectively). Similar saw tooth shape is observed for the rate of satisfaction for infrastructure ETFs, with high figures in 2010, 2012, 2014, 2015 and 2018 (95%, 83%, 86%, 86%, and 71%, respectively) and lower figures in 2011, 2013, and 2016 (67%, 67%, and 45%, respectively).

This may be due to the suitability of ETFs to more liquid asset classes or the fact that investor expectations are still adjusting with regard to the benefits and drawbacks of ETFs based on those asset classes. For instance, we observed large variations through years in the number of users of ETFs for these two asset classes, as well as in the share of investment dedicated to ETFs. However, it should be noted that the sample of respondents who indicated their level of satisfaction with infrastructure ETFs was very small, with only seven providing responses this year. Similarly, the sample of respondents who answered whether or not they were satisfied with hedge fund ETFs was also quite small, with only six providing responses in 2018. As a result, a single respondent opinion has a considerable impact on the result.

Use of ETFs for Different Purposes

It is interesting to note that, while arbitrage trading between ETFs and the underlying basket of cash securities was an activity used by a considerable fraction of respondents in the past, there has been very little interest in this type of use for a number of years now, suggesting that respondents perceive ETF pricing relative to NAV to be precise. In 2010, the percentage of respondents who frequently used ETFs for arbitrage purposes was 10%. In 2012,

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only 5% of respondents frequently used ETFs for arbitrage. In 2016, only 2% of the respondents declared that they frequently used ETFs for arbitrage, to be compared with 6% in 2018. The main purpose for using ETFs is still to obtain broad market exposure, with more or less 70% of respondents declaring using ETFs for this purpose since 2009 (see Exhibit 4.18).

Future use of ETFs

Finally, we also look at the investors' expected usage of ETFs over time. The results are shown in Exhibit 4.19. The results suggest that despite the past growth and increasing maturity of the ETF market, investors are still looking to increase (or to at least maintain) their use of ETFs. By summing the percentage of respondents who answered "Increase" or "Stay the same", the total has stayed above 90% since 2009. The percentage of respondents planning to increase their use of ETFs which has remained around 60% from 2013 to 2016, is now around 50%, with a transfer towards the percentage of respondents who answered that their use of ETFs would stay the same which is now not far from 50%, leaving only around 3% of respondents that planned to reduce their use of ETFs. Against the backdrop that this survey only covers respondents who are already ETF investors, the still large share of increase in expected usage is even more remarkable.

65 - The question was not asked in the survey before 2009.

Exhibit 4.18: Frequent Use of ETFs for the Following Purposes Over Time.
This exhibit indicates the percentages of respondents frequently using ETFs for each of the mentioned purposes over time. Respondents were asked to rate the frequency from 1 to 6. The "frequent" category would include ratings from 4 to 6. The percentages are based on the results of ETF survey 2009 to 2018.[65]

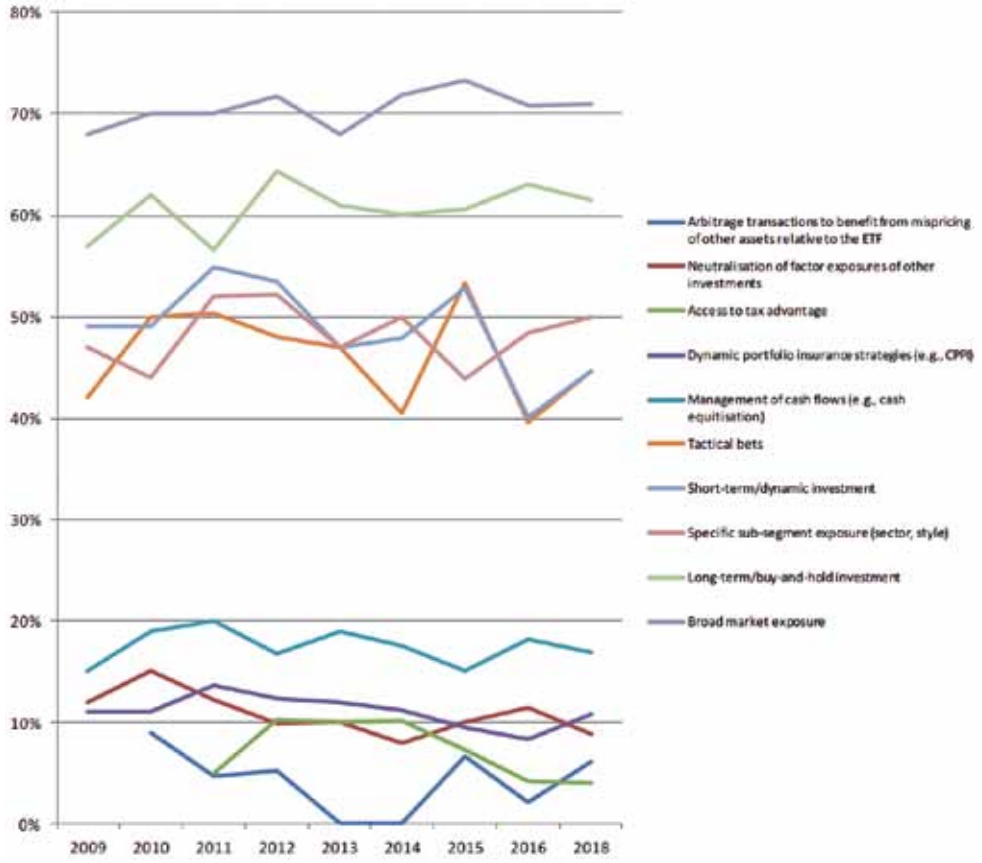

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Exhibit 4.19: How Do You Plan the Evolution of Your Use of ETFs?
This exhibit indicates the future potential to change the use of ETFs by investors over time. The percentages are based on the results of the EDHEC ETF survey in 2006, and from 2008 to 2018.

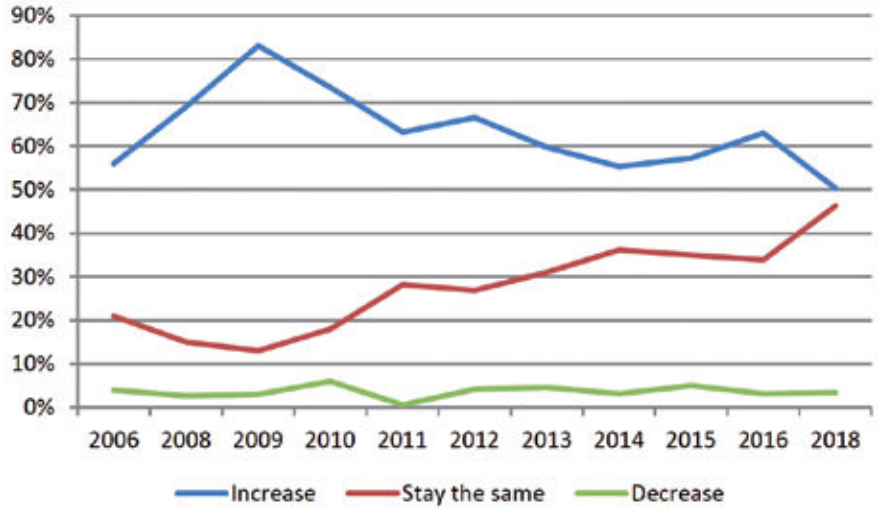
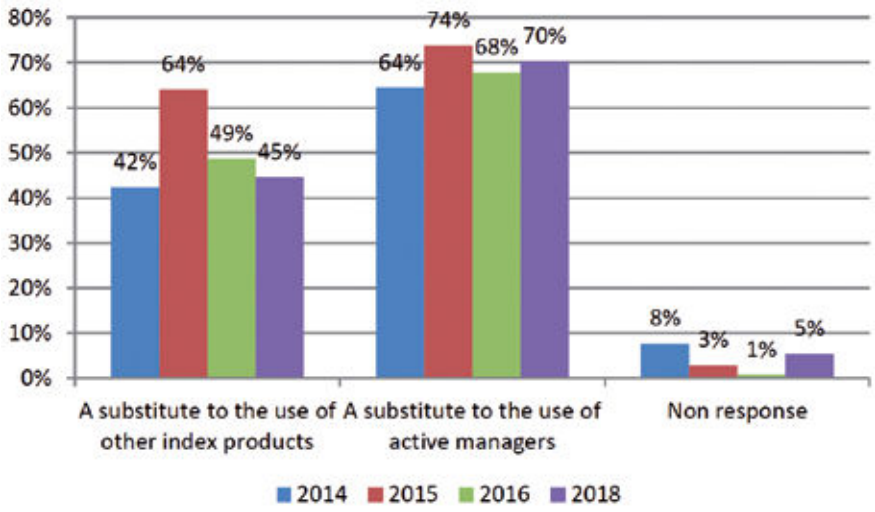


Exhibit 4.20: Increase in the Use of ETFs Will Serve As...
This exhibit indicates the reasons given by respondents for planning to increase their use of ETFs. More than one response could be given.



Since 2014, we ask respondents who stated that they planned to increase their use of ETFs about their motivations for planning such an increase. The results are displayed in Exhibit 4.20. Since then, a vast majority of respondents, starting at around two-thirds of them in 2014 and even reaching three-quarters of them in 2015, indicated that increasing the use of ETFs would serve as a substitute to the use of active managers. As explained in Section 4.1.4, this result should be associated with the disappointing performance of active management. Investors may see the use of ETFs as more profitable and less costly than the use of active managers. With an average of half of the respondents, over the four years, substituting ETFs in favour of other index products is also a major reason for the increasing use of ETFs.

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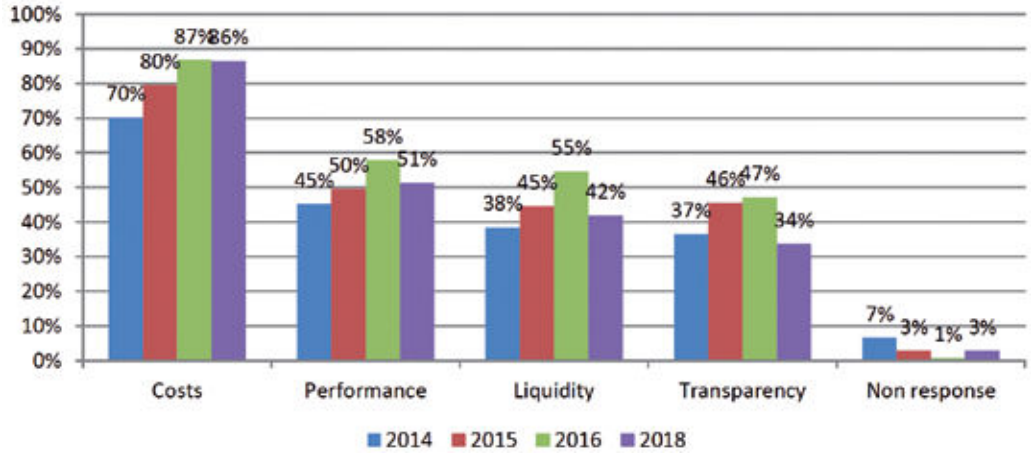
Exhibit 4.21: Increase in the Use of ETFs Will Be Motivated By...
This exhibit indicates the motivations given by respondents for planning to increase their use of ETFs. More than one response could be given.



The hypothesis of reducing costs with an increase in the use of ETFs is confirmed as survey respondents declare that this replacement will first of all be motivated by costs, with a percentage starting from 70% in 2014 to stabilise at 86% in 2018 (see Exhibit 4.21). The second motivation given by respondents is performance, with more or less 50% of respondents between 2014 and 2018. Liquidity is the third criteria given, with more or less 45% of respondents between 2014 and 2018, a comparable, but a little lower level than performance. Transparency is the last criteria given, with 37% of respondents in 2014 versus 34% in 2018. It should be noted that if we observe an increase since 2014 for the first three motivations, transparency shows a slight decrease since then.

Smart Beta and Factor Investing ETFs

In this first section of the survey, we collected initial results about investor perceptions of smart beta and factor investing strategies, through their use of smart beta and factor investing ETFs, showing their increasing interest, as well as the high satisfaction rate with ETFs within this asset class (see Exhibit 4.22). About two-thirds of respondents (67%) used ETFs or ETF-like products to invest in smart beta and factor investing in 2018, a considerable increase compared to 49% in 2014. Since 2013, the satisfaction rate with smart beta and factor investing ETFs is quite high, though we observe variations from one year to another. Also, if around one-third of smart beta investing was made through ETFs since 2013, there has been a significant increase in 2018, as not far from half of total investment in smart beta and factor investing is made through ETFs. Consequently, if around one-third of respondents still had further demands in 2016 for ETFs based on smart beta indices, a percentage that has slightly decreased since 2013 when 39% of respondents had further demands, they are not much more than a quarter in 2018. The large use of ETFs based on smart beta and factor investing indices, as well as the wishes for additional developments, fully justify that a large share of our survey is dedicated to smart beta and factor investing strategies, the results of which will be presented in the following section.

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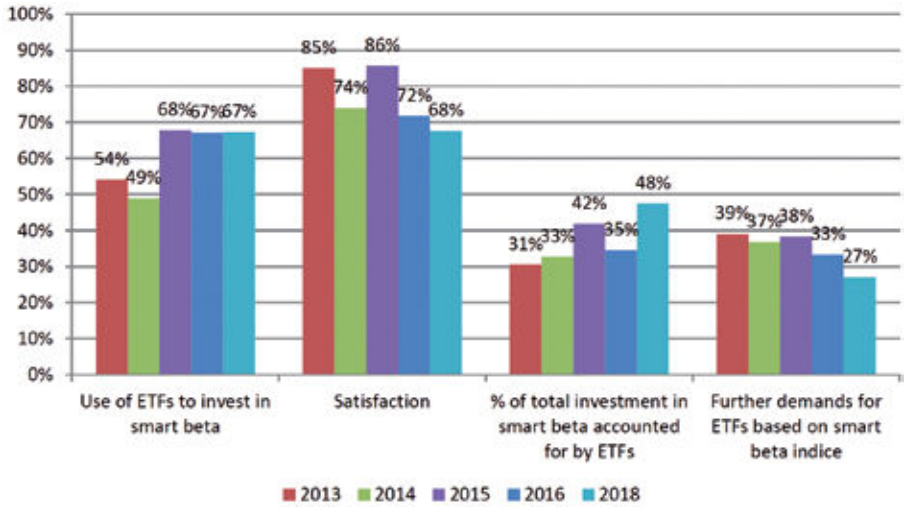
Exhibit 4.22: Smart Beta ETFs: Use and Satisfaction
This exhibit indicates the use of and satisfaction with smart beta ETFs from 2013 to 2018.



4.2. Smart Beta and Factor Investing Strategies

The results of the first section of the survey have shown interest of respondents for ETFs that track smart beta and factor investing indices. In this second section of the survey, we invite survey participants to give their opinion on smart beta and factor investing strategies beyond their use through ETFs. While questions about smart beta and factor investing products were first introduced in our 2013 survey, this group of questions were considerably developed last year, in view of the increasing interest of these strategies to improve passive investment. The emergence of smart beta and factor investing products offers exposure to a variety of alternatively weighted indices. Indeed, there is recent evidence that combining optimal portfolios constructed under different assumptions results in a higher probability of outperformance (compared to the cap-weighted index) over market cycles than any one alternatively constructed weighting scheme. So, it would make sense that investors would benefit from exploiting such diversification-based strategies.

For instance, Amenc et al. (2012a) show that a global minimum variance strategy does well in adverse market conditions, while Maximum Sharpe Ratio portfolios provide greater access to the upside of equity markets. As the relative performance of these two diversification approaches depends on market conditions, they show that a combination of both approaches leads to a smoother conditional performance and higher probability of outperformance of the cap-weighted index.

In this section, we begin by analysing the use of smart beta and factor investing strategies, in terms of the number of investors and in terms of the amount of investment, as well as the strategies used to invest in smart beta and factor investing solutions. A section is specifically dedicated to smart beta and factor investing for fixed-income strategies. Respondents were then invited to share their opinions on smart beta and factor investing indices and on the information they require before investing in smart beta and factor investing strategies. They were also asked to express their views on the evolution of their planned future

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use of smart beta and factor investing strategies. Finally, we look at the trends in the use of smart beta and factor investing strategies observed over the last four years.

4.2.1. Use of Smart Beta and Factor Investing Strategies

Respondents were first asked about their use of products that track smart beta and factor investing indices. From Exhibit 4.23, we can see that 46% of respondents already use products that track smart beta and factor investing indices, and that 28% of them are considering investing in such products in the near future. These results show that investors already have large interest in such products. Compared to last year, we see a slight increase in the share of respondents that already use products that track smart beta and factor investing indices. Consequently, we observe a small decrease in the percentage of respondents that consider investment in such products in the near future. However, the cumulative percentage of those that already invest, or that are considering investing in smart beta and factor investing in the near future, is still slightly higher in 2018 than in 2016, which gives room for further development of this investment in the near future.

For those who already invest in smart beta and factor investing strategies, respondents were asked the percentage of total investment already invested in smart beta and factor investing solutions. The results are displayed in Exhibit 4.24. More than four-fifths of respondents (83%) invest less than 20% of their total investments in smart beta and factor investing strategies. If we compare these results to those presented in Exhibit 4.23, it appears that, while there are still more respondents who invest in smart beta and factor investing strategies, a vast majority of them still dedicate a restricted share of investment to smart beta and factor investing strategies. Among the 17% of respondents that invest more than 20% in smart beta and factor investing strategies, 6% of them invest between 20% and 40% of their total investments in smart beta and factor investing strategies, 8% of them invest between 40% and 60% of their total investment, while only 4% of respondents invest more than 60% of their total investments in smart beta and

Exhibit 4.23: Use of Products that Track Smart Beta and Factor Investing Indices
This exhibit indicates the percentages of respondents that reported using products that track smart beta and factor investing indices. Non-responses are excluded. We also displayed 2016 results to show the evolution of results between the two years.

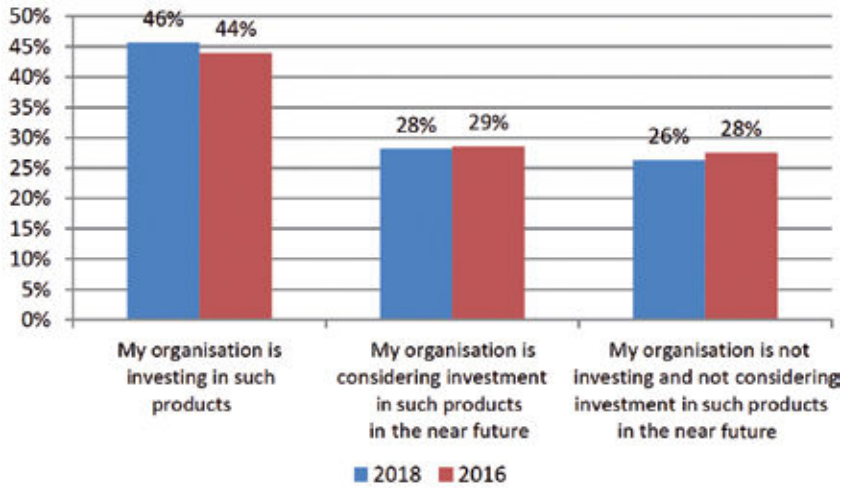

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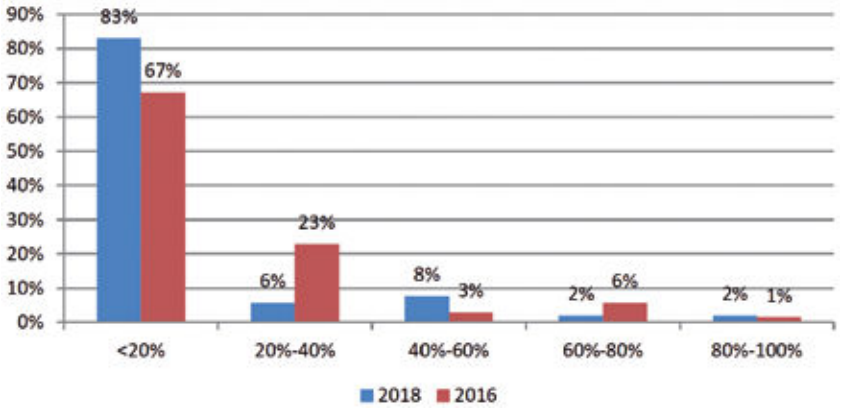
Exhibit 4.24: Percentage of Total Investment Already Invested in Smart Beta and Factor Investing Solutions
This exhibit indicates the average percentage of total investment already invested in smart beta and factor investing solutions. We only consider respondents that already use smart beta and factor investing strategies. We also displayed 2016 results to show the evolution of results between the two years. Non-responses are excluded.

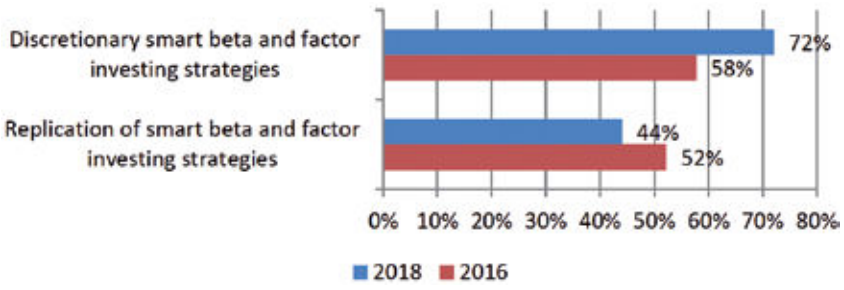


factor investing strategies. If we compare the present results to those obtained in 2016, they are in indeed not so different, as 89% of respondents in 2018, versus 90% in 2016, dedicate less than 40% of their total investment to smart beta and factor investing strategies. These results confirm that there is still room for further development of this investment in the near future.

Respondents already investing in smart beta and factor investing strategies were also asked to detail the category of smart beta and factor investing strategies they invest in. The results are displayed in Exhibit 4.25. It appears that considerably more respondents use discretionary smart beta and factor investing strategies rather than resort to replication of smart beta and factor investing strategies (72%, versus 44%). Only 16% of respondents use both categories of strategies. Compared to 2016, where the spread between the use of the two types of strategies were not so wide, we observe a large increase in the use of discretionary strategies (72% in 2018, versus 58% in 2016), while the use of replication strategies has somewhat regressed (44% in 2018, versus 52% in 2016).

Respondents already investing in smart beta and factor investing strategies were finally asked to explicitly state the wrapper they use to invest in smart beta and factor investing strategies. The results are displayed

Exhibit 4.25: Strategies used to Invest in Smart Beta and Factor Investing Solutions
This exhibit indicates the categories of smart beta and factor investing strategies respondents invest in. The percentages are based on the sole respondents that already use smart beta and factor investing strategies. More than one response could be given. We also displayed 2016 results to show the evolution of results between the two years. Non-responses are excluded.



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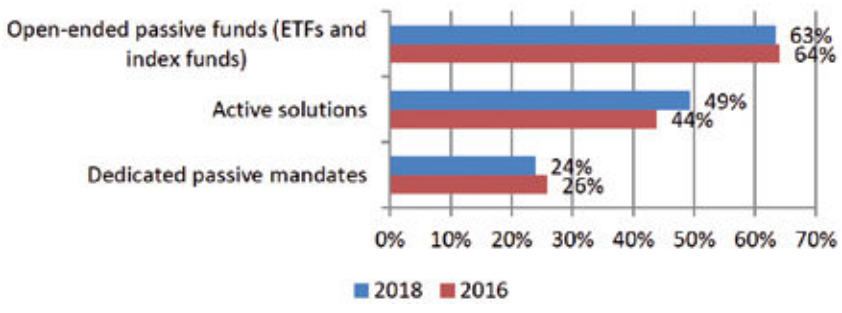
in Exhibit 4.26. It appears that a majority of respondents (63%) use open-ended passive funds (ETFs and index funds) as a wrapper for smart beta and factor investing strategies. Almost half of them (49%) use active solutions, while about a quarter of them (24%) use dedicated passive mandates. While the vast majority of respondents (72%) use only one category of wrapper, some of them use two or three different categories of wrapper. 4% of respondents use both categories of passive wrappers. Some respondents use active solutions and only one category of passive wrapper – open-ended passive funds for 13% of them and dedicated passive mandates for 3% of them. Finally, 8% of respondents declare using the three categories of wrappers. All these results remain quite similar with the ones obtained in 2016.

The remaining questions of the smart beta and factor investing section of the survey were proposed to all respondents whether or not they already invest in smart beta and factor investing strategies. Respondents were asked to rate the advantages of discretionary smart beta and factor investing strategies and of replication of smart beta and factor investing strategies. The results are displayed in Exhibit 4.27 for discretionary smart beta and factor investing strategies and in Exhibit 4.28 for the replication of smart beta and factor investing strategies. Exhibit 4.29 compares the favourable scores for both strategies. From Exhibits 4.27 and 4.28, it appears that the majority of respondents have a favourable opinion of all the characteristics of both strategies, as all of them are considered to be favourable for more than 50% of respondents. It is also interesting to note that the percentage of respondents having a favourable opinion of the various characteristics of the strategies have increased for most of them compared to 2016. This is the case for six among eight characteristics of discretionary strategies, the opinion about the other two (availability of information for assessing strategies, transparency of methodology) having remained equal to the one observed in 2016. If two characteristics of replication strategies have seen a slight decline in favourable opinions (transparency of methodology and ease of use as building blocks in portfolio allocation), and one (costs) has remained equal to the one observed in 2016, this is also for those strategies that the most spectacular increases in favourable opinions are to be found for some of the characteristics, including mitigating

Exhibit 4.26: Wrapper Used to Invest in Smart Beta and Factor Investing Solutions
This exhibit indicates the categories of wrapper respondents use to invest in smart beta and factor investing strategies. The percentages are based on the sole respondents that already invest in smart beta and factor investing strategies. More than one response could be given. We also displayed 2016 results to show the evolution of results between the two years. Non-responses are excluded.



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possible conflict of interest providers vs. investor (73% of favourable opinions in 2018, versus 54% in 2016), broadness of the available solutions (72% in 2018, versus 51% in 2016), and possibility to create alignment with investment beliefs (74% in 2018, versus 61% of 2016).

The comparison between the characteristic scores for the two categories of strategies is also interesting. Some characteristics receive similar scores for both categories of strategies, as the possibility to create alignment with investment beliefs, which is considered as favourable for 74% of respondents, both for discretionary smart beta and factor investing strategies and replication of smart beta and factor investing strategies. Other characteristics receive favourable scores in the same ranges for both strategies, but with a slight advantage for discretionary smart beta and factor investing strategies. Among these are the transparency of methodology, and ease to change portfolio allocation over time, with 64%, and 73% of respondents, respectively, finding them favourable for the discretionary smart beta and factor investing strategies, versus 62%, and 71%, respectively, for replication of smart beta and factor investing strategies. For the ease of use as building blocks in portfolio allocation, the advantage is a little stronger, in favour of the discretionary strategies (73%, versus 64% for replication strategies).

For the other four characteristics, the advantage is to be found for the replication of smart beta and factor investing strategies. It is mainly in terms of mitigating possible conflict of interest provider versus investor that respondents find that replication of smart beta and factor investing strategies has a definite advantage over discretionary smart beta and factor investing strategies, as 73% of respondents find it favourable for the former, against only 54% for the latter. Broadness of the available solutions is also quite more favourable for replication strategies, than for discretionary strategies 72% versus 58%). To a lesser extent, availability of information for assessing

Exhibit 4.27: Advantages of Discretionary Smart Beta and Factor Investing Strategies
This exhibit indicates how respondents rate the advantages of discretionary smart beta and factor investing strategies. Respondents were asked to rate the various advantages from 0 (not favourable) to 5 (highly favourable). The "favourable" category would include ratings from 3 to 5 and "not favourable" would take into account ratings from 0 to 2, so that the percentages of "favourable" and "not favourable" scores add up to100%. Non-responses are excluded. This exhibit only displays the favourable score, together with 2016 results to show the evolution of results between the two years.

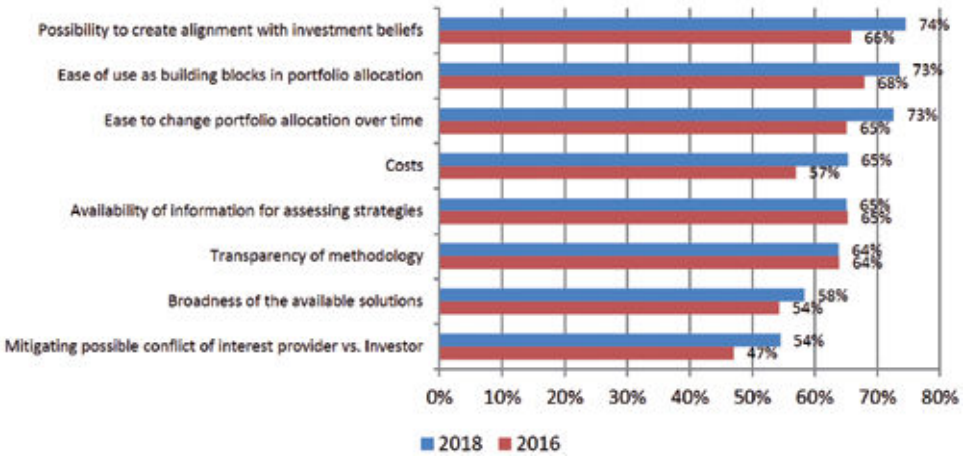

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Exhibit 4.28: Advantages of Replication of Smart Beta and Factor Investing Strategies
This exhibit indicates how respondents rate the advantages of replication of smart beta and factor investing strategies. Respondents were asked to rate the various advantages from 0 (not favourable) to 5 (highly favourable). The "favourable" category would include ratings from 3 to 5 and "not favourable" would take into account ratings from 0 to 2, so that the percentages of "favourable" and "not favourable" scores add up to100%. Non-responses are excluded. This exhibit only displays the favourable score, together with 2016 results to show the evolution of results between the two years.

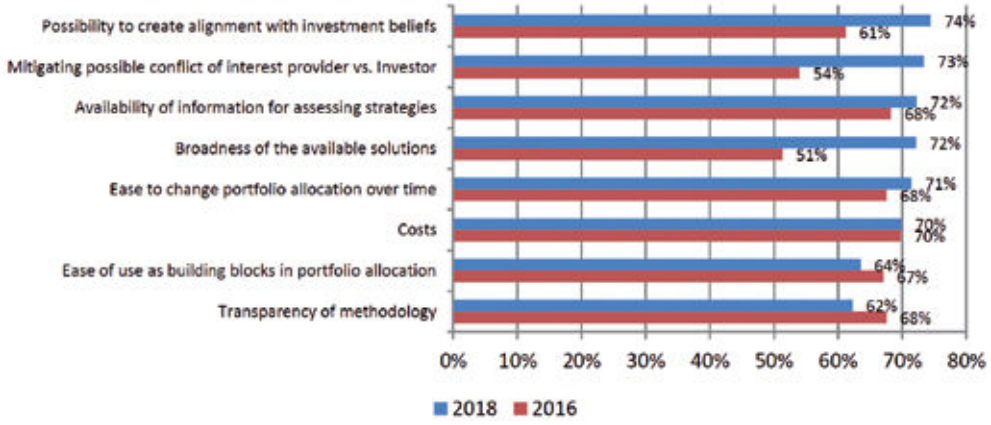
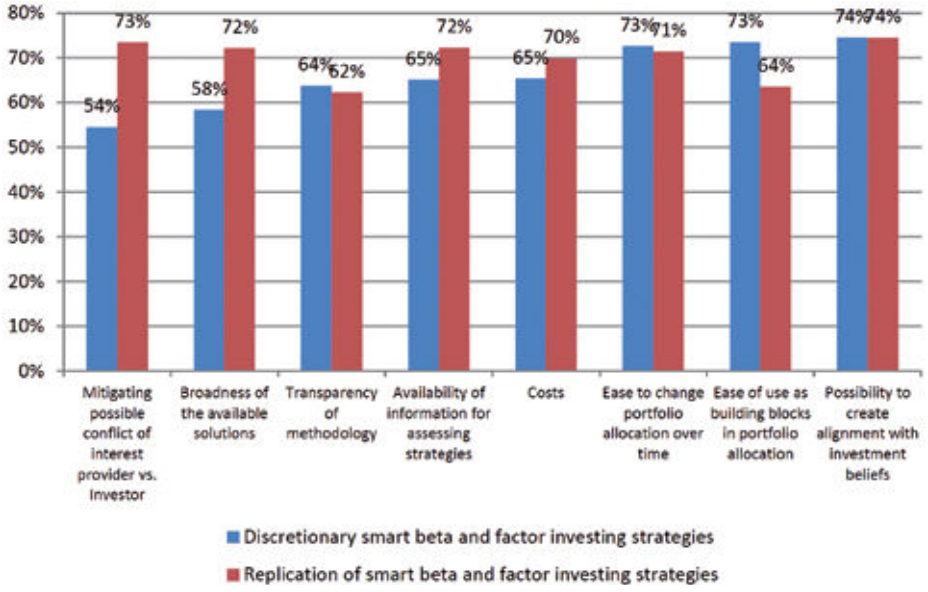


Exhibit 4.29: Comparison of the Advantages of Discretionary of Smart Beta and Factor Investing Strategies with the ones of Replication of Smart Beta and Factor Investing Strategies
This exhibit compares the favourable scores obtained for each advantage of discretionary smart beta and factor investing strategies with the ones of replicated smart beta and factor investing strategies. Non-responses are excluded.



strategies and costs are considered to be more favourable with replication of smart beta and factor investing strategies (72% and 70% of respondents, respectively), than with discretionary smart beta and factor investing strategies (65% of respondents for them both). Exhibit 4.29 provides more detail.

4.2.2. Smart Beta and Factor Investing Strategies in Fixed-income

This year, we introduce a special focus on fixed-income smart beta and factor investing strategies in our survey. Exhibit 4.30 shows that only 17% of the total sample of respondents already use smart beta and factor investing strategies for fixed-income. If we only consider the

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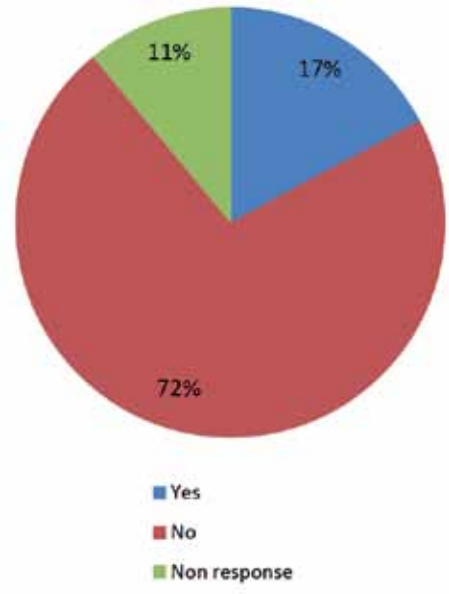
sub-sample of those respondents that reported already investing in products that track smart beta and factor investing indices (see Exhibit 4.23), we find that a little more than a quarter of them (27%) use smart beta and factor investing strategies for fixed-income. This result is not surprising as, fixed-income smart beta and factor investing strategies is at the top of the list when respondents are asked about the products that require further developments (see Exhibit 4.48 in Section 4.2.6).

Exhibit 4.30: Do You Already Invest in Smart Beta and Factor Investing Strategies for Fixed-income?
This exhibit indicates the percentage of respondents that reported investing in smart beta and factor investing strategies for fixed-income. Percentages are based on 163 replies to the survey.



For those who already invest in smart beta and factor investing strategies for fixed-income, respondents were asked the percentage of total investment already invested in smart beta and factor investing solutions for fixed-income. The results are displayed in Exhibit 4.31. Four-fifths of respondents (80%) invest less than 20% of their total investments in smart beta and factor investing strategies for fixed-income. This result is quite comparable with the one obtained for investment in smart beta and factor investing solutions in general (see Exhibit 4.24). Among the 20% of respondents that invest more than 20% in smart beta and factor investing strategies, 12% of them invest between 20% and 40% of their total investments in smart beta and factor investing strategies and 8% of them invest between 40% and 60% of their total investment. These results confirm that there is considerable room for further development of this investment in the near future.

In order to have more information about the needs and requirements of respondents in the area of smart beta and factor investing for fixed-income, respondents were asked to give their opinion about a list of assertions. Results are displayed in Exhibit 4.32. It appears that respondents show a significant interest for smart beta and factor investing for fixed-income with a score of 3.13, on a scale from 0 (strongly disagree) to 5 (strongly agree). However, there is a significant gap between the interest in this investment and the forecast of an increase in it, as when asked about their plan to increase their investment in smart beta and factor investing for fixed-income, the average score of agreement with this statement is only of 2.34. The following statements give some explanation about this gap. First, the average score of agreement with the statement that smart beta and factor investing equity approach is transposable for fixed-income is only of 2.16; second, respondents consider that there is not enough research in the area of smart beta and factor investing for fixed-income (average score of 1.65).

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Exhibit 4.31: Percentage of Total Investment Already Invested in Smart Beta and Factor Investing Strategies for Fixed-Income
This exhibit indicates the average percentage of total investment already invested in smart beta and factor investing solutions for fixed-income. We only consider respondents that already use smart beta and factor investing strategies for fixed-income. Non-responses are excluded.

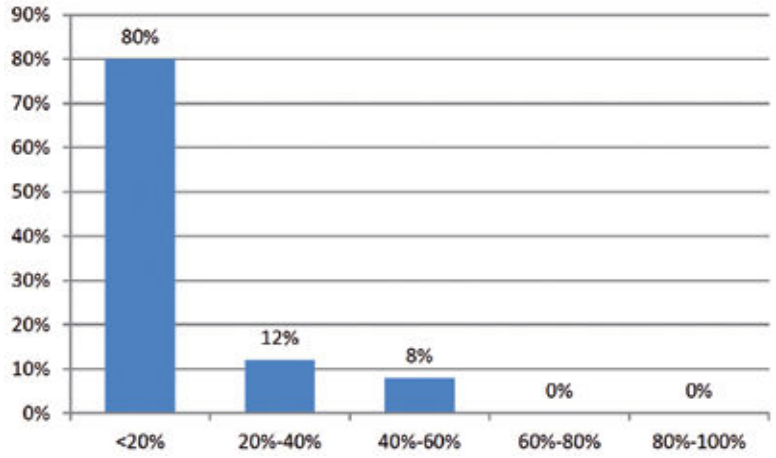
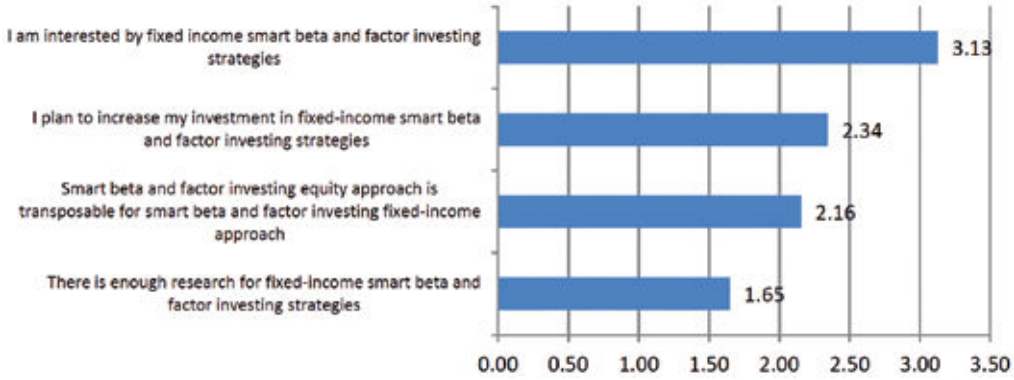


Exhibit 4.32: Opinion of Respondents about Statements Concerning Smart Beta and Factor Investing for Fixed-income.
This exhibit indicates the agreement of respondents with the statement on a scale from 0 (strongly disagree) to 5 (strongly agree). More than one response could be given. Non-responses are excluded.



Respondents were then more specifically asked about how to achieve efficient harvesting of risk premia in bond markets. They were made three propositions. The first one was the application of smart weighting schemes (minimum variance, risk parity, etc.) to a broad universe (in short, smart beta). The second one was the selection of bonds according to rewarded attributes such as value, momentum, credit, liquidity etc. (in short, factor investing). And the third one was the application of smart weighting schemes to factor-tilted selections of bonds (in short, smart factor investing). Results are displayed on Exhibit 4.33. It appears that half of respondents (54%) think that the best solution is factor investing. More than a quarter of them (27%) think it is smart factor investing and one-fifth of them (20%) think it is smart beta.

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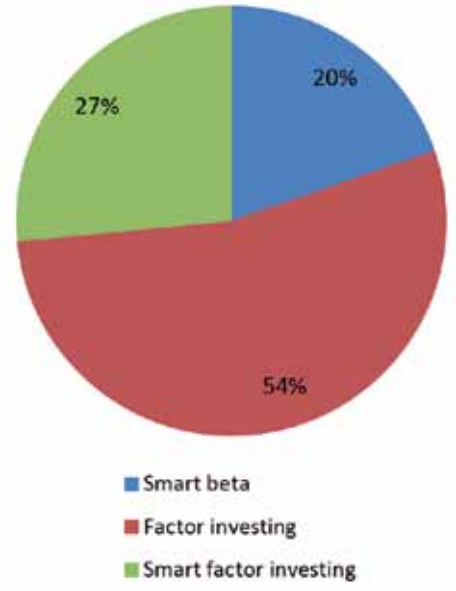
Exhibit 4.33: How should Investors Achieve Efficient Harvesting of Risk Premia in Bond Markets?
This exhibit indicates the opinion of respondents on how to achieve efficient risk harvesting of risk premia in bond markets. Non-responses are excluded.

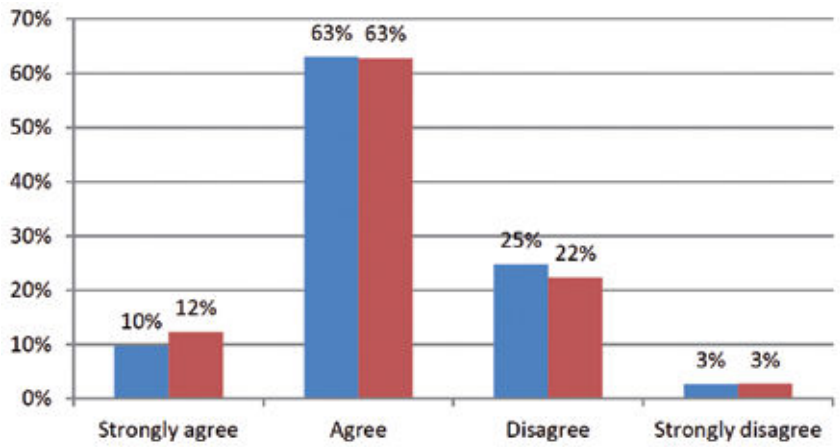


4.2.3. Smart Beta and Factor Investing Indices

Investors were then asked about their agreement with different propositions. Smart beta and factor investing indices were developed to overcome the shortcomings of cap-weighted indices, among which were their poor risk-adjusted performance (Haugen and Baker, 1991; Grinold, 1992; Schwartz, 2000; Cochrane, 2005; Arnott, Hsu and Moore, 2005; Amenc, Goltz and Le Sourd, 2006; Goltz and Le Sourd, 2011, among others). So, respondents were first asked if, in their view, smart beta and factor investing indices provided significant potential to outperform cap-weighted indices in the long term.

From Exhibit 4.34, we can see that a vast majority of respondents agree that smart beta and factor investing indices provide significant potential to outperform cap-weighted indices in the long term, as almost three-quarters of them (73%) indicate they agree or strongly agree with this argument among which 10% of them strongly agree with this assertion. The results are quite comparable to those obtained in 2016 in terms of distribution between the four possible answers. It thus appears that a vast and stable group of investors are now convinced of the superiority of smart beta and factor investing indices in terms of performance over the long term.

Exhibit 4.34: Do You Think Smart Beta and Factor Investing Indices Provide Significant Potential to Outperform Cap-weighted Indices in the Long Term?
This exhibit indicates the percentages of agreement with this statement. Non-responses are excluded. We also displayed 2016 results to show the evolution of results between the two years.



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Then, respondents were asked if they thought smart beta and factor investing indices allowed factor risk premia such as value and small-cap to be captured. From Exhibit 4.35, it appears that a vast majority of respondents (91%) agree or strongly agree that smart beta and factor investing indices allowed such factor risk premia to be captured, a percentage even higher than the already high value of 89% obtained in 2016 particularly that to an increase among respondents who agree with the statement.

Another important shortcoming of cap-weighted indices documented in the literature is their overly concentration (see Tabner, 2007; Malevergne, Santa Clara and Sornette, 2009). So, respondents were asked if they thought smart beta and factor investing indices allowed the concentration of cap-weighted indices in very few stocks or sectors to be avoided. Here again, from Exhibit 4.36, we can see that a large share of respondents, namely three-quarters of them (75%) agree or strongly agree that smart beta and factor investing indices allow the concentration of cap-weighted

Exhibit 4.35: Do You Think Smart Beta and Factor Investing Indices Allow Factor Risk Premia Such As Value and Small-Cap to Be Captured?
This exhibit indicates the percentages of agreement with this statement. Non-responses are excluded. We also displayed 2016 results to show the evolution of results between the two years.

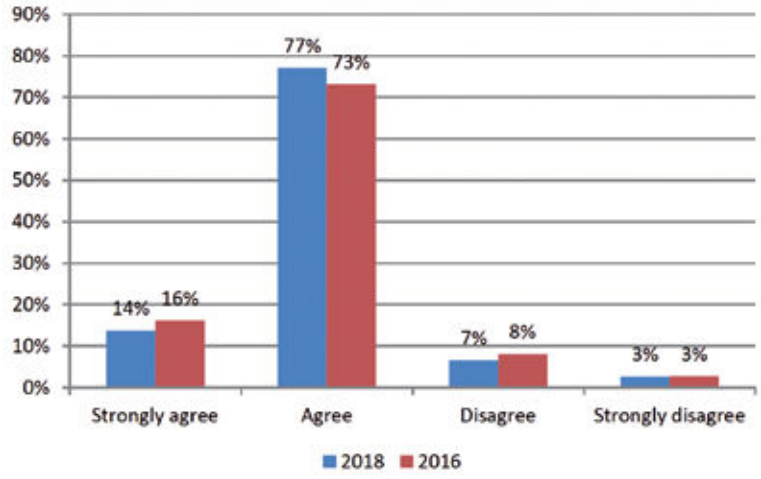
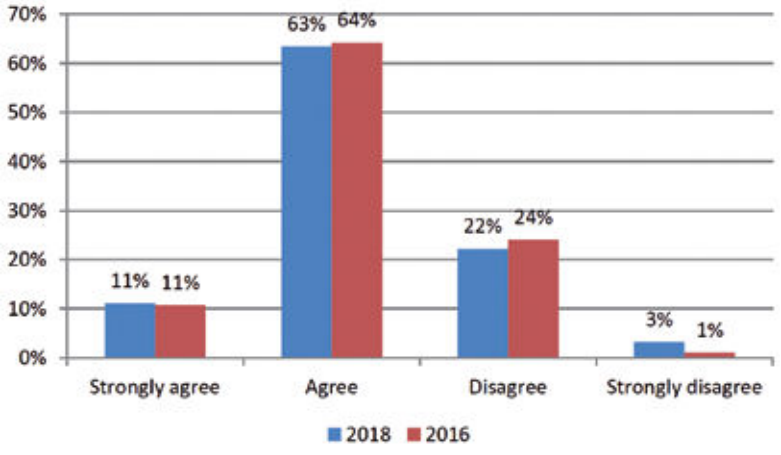


Exhibit 4.36: Do You Think Smart Beta and Factor Investing Indices Allow the Concentration of Cap-weighted Indices in Very Few Stocks or Sectors to Be Avoided?
This exhibit indicates the percentages of agreement with this statement. Non-responses are excluded. We also displayed 2016 results to show the evolution of results between the two years.



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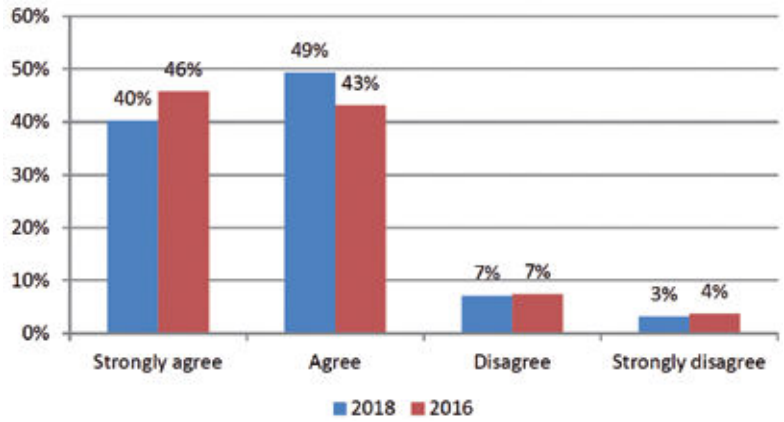
indices in very few stocks or sectors to be avoided, which is similar to 2016 results.

Further, respondents were asked if they thought that smart beta and factor investing indices require full transparency on methodology and risk analytics. From Exhibit 4.37, we can see that the vast majority of respondents (90%) agree or strongly agree with this statement, a percentage showing a slight increase compared to the very high figure of 89% obtained in 2016. Further, when breaking down this figure we observe a small decrease in respondents that strongly agreed with the statement (40% in 2018, compared to 46% in 2016).

These results confirm earlier research on the need for transparency of index investors in general. In particular, in a survey conducted among European investors on their perception of index transparency, Amenc and Ducoulombier (2014) found strong conviction among respondents that the transparency currently offered by index providers is, in general, inadequate. Moreover, their results show that the rise of strategy indices makes transparency even more important and that opacity undermines the credibility of reported track records, in particular for new forms of indices. When reviewing existing indices and their disclosure practices, Amenc and Ducoulombier (2014) find that a number of providers failed to disclose the full calculation methodology that would allow for replication of their strategy indices (e.g. formulae or procedures were not properly described or specified, proprietary or third-party models were used but not provided). They also find that for smart beta and factor investing indices used by UCITS, only three out of five index firms provided a full history of their index closing levels. In the Edhec-Risk Alternative Equity Beta Investing survey, Amenc et al., (2015a) find similar strong evidence on severe shortcomings of alternative equity beta strategies in terms of the transparency they offer investors. In fact, "limited information on risks" and "limited access to data" appear to be some of the biggest hurdles in terms of alternative equity beta adoption by investors. Moreover, when asked about the importance of different assessment criteria when evaluating advanced beta offerings, respondents saw transparency as one of the key criteria.

Exhibit 4.37: Do You Think Smart Beta and Factor Investing Indices Require Full Transparency on Methodology and Risk Analytics? This exhibit indicates the percentages of agreement with this statement. Non-responses are excluded. We also displayed 2016 results to show the evolution of results between the two years.



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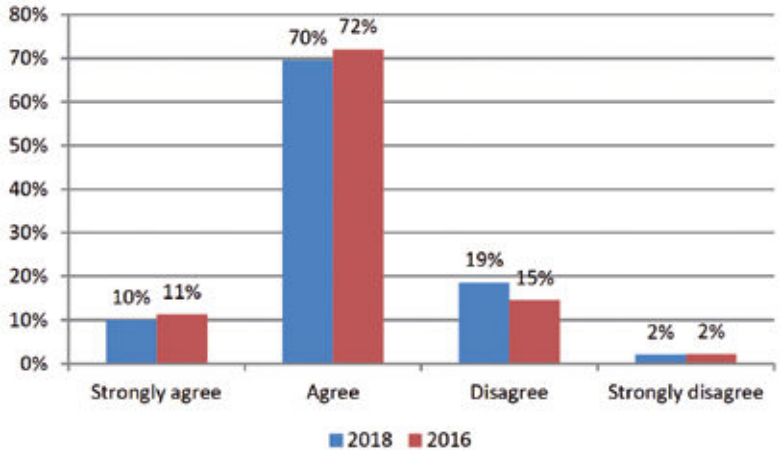
Finally, respondents were asked if they thought diversification across several weighting methodologies allowed risk to be reduced and added value. From Exhibit 4.38, we can see that almost four-fifths of respondents (79%) agree or strongly agree that diversification across several weighting methodologies allows risk to be reduced and adds value, a percentage showing a slight decrease compared to the high figure of 83% obtained in 2016, but which is similar to the 79% figure obtained in 2015.

These results are in line with a rich academic background. Indeed, as demonstrated by Kan and Zhou (2007), Tu and Zhou (2011), and Amenc et al., (2012b), combining the different weighting schemes helps to diversify away unrewarded risks and parameter estimation errors. Stock-specific risk (such as management decisions, product success, etc.) is reduced through the use of a suitable diversification strategy. However, due to imperfections in the model, residual exposures to unrewarded strategy-specific risks remain. For example, Minimum Volatility portfolios are often exposed to significant sector biases. Similarly, in spite of all the attention paid to the quality of model selection and the implementation methods for these models, the specific operational risk remains present to a certain extent. The robustness of the Maximum Sharpe Ratio scheme depends on a good estimation of the covariance matrix and expected returns. The parameter estimation errors of optimised portfolio strategies are not perfectly correlated and therefore have potential to be diversified away (Kan and Zhou, 2007; Amenc et al., 2012b). A Diversified Multi-Strategy approach,[66] which combines the five different weighting schemes in equal proportion, enables the non-rewarded risks associated with each of the weighting schemes to be diversified away.

In conclusion, respondents show great interest in products based on smart beta and factor investing indices as they see them as providing potential improvement in their investment, and this interest is still growing (or is at least remaining at comparable high levels), as shown by a comparison with the results of 2016. In addition, they have major concerns about the quality of these products, as 90% of them think that smart beta and factor

66 - Diversified Multi-Strategy weighting is an equal weighted combination of the following five weighting schemes – Maximum Deconcentration, Diversified Risk-Weighted, Maximum Decorrelation, Efficient Minimum Volatility and Efficient Maximum Sharpe Ratio (Lodh and Sivasubramanian, 2018).

Exhibit 4.38: Do You Think That Diversification Across Several Weighting Methodologies Allows Risk to Be Reduced and Adds Value? This exhibit indicates the percentages of agreement with this statement. Non-responses are excluded. We also displayed 2016 results to show the evolution of results between the two years.



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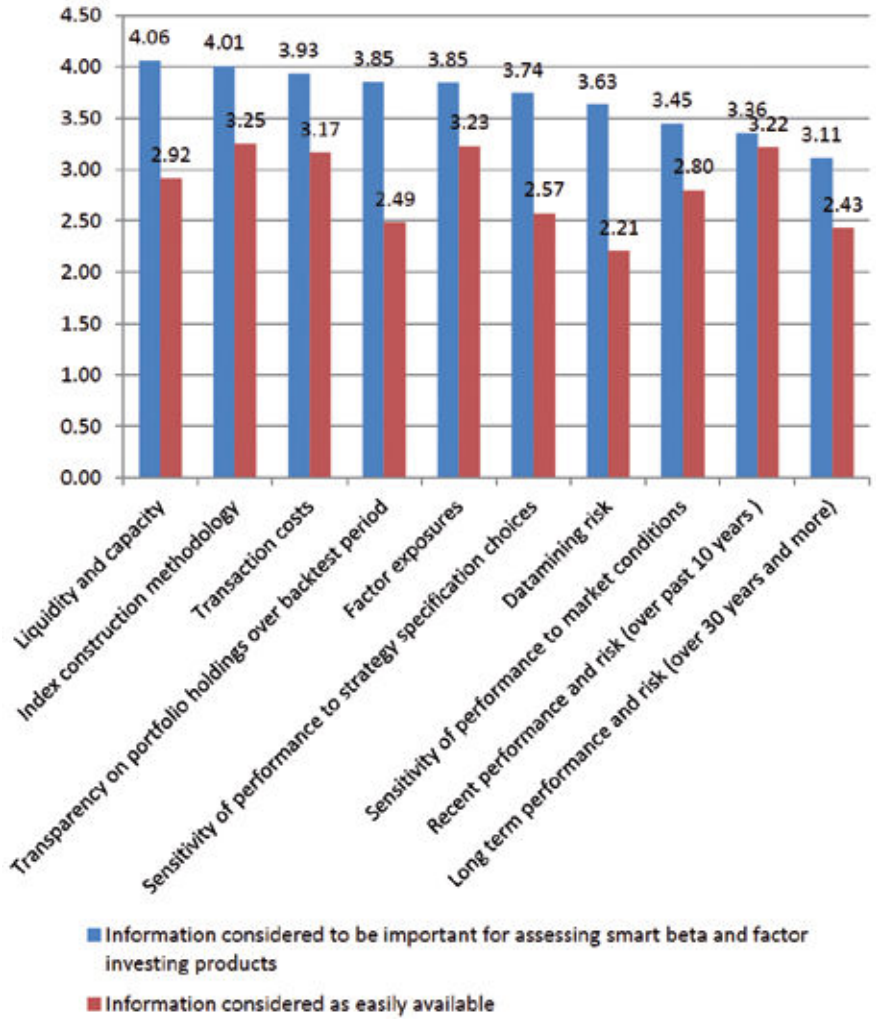
investing indices require full transparency on methodology and risk analytics.

4.2.4. Information about Smart Beta and Factor Investing Strategies

We then asked respondents about the information they consider important to assess smart beta and factor investing. At the same time, respondents were asked whether they considered this information easily available (see Exhibit 4.39). It is thus interesting to see the spread between the importance of and the accessibility to this information. It appears that the highest spread is observed for information respondents considered as crucial. For example, data-mining risk and information about transparency on portfolio holdings over a back-test period are two crucial pieces of information for respondents, with scores of 3.63 and 3.85, respectively. Data-mining risk is also the information that appears to be the most difficult to obtain for respondents, with a score of 2.21, while information about transparency on portfolio holdings over a back-test period is among the three most difficult pieces of information to obtain, with a score of

Exhibit 4.39: Information About Beta Products
This exhibit indicates the information respondents consider important for assessing smart beta and factor investing products on a scale from 0 (not important) to 5 (crucial) and which information they consider to be easily available on a scale from 0 (difficult to obtain) to 5 (easy to obtain).



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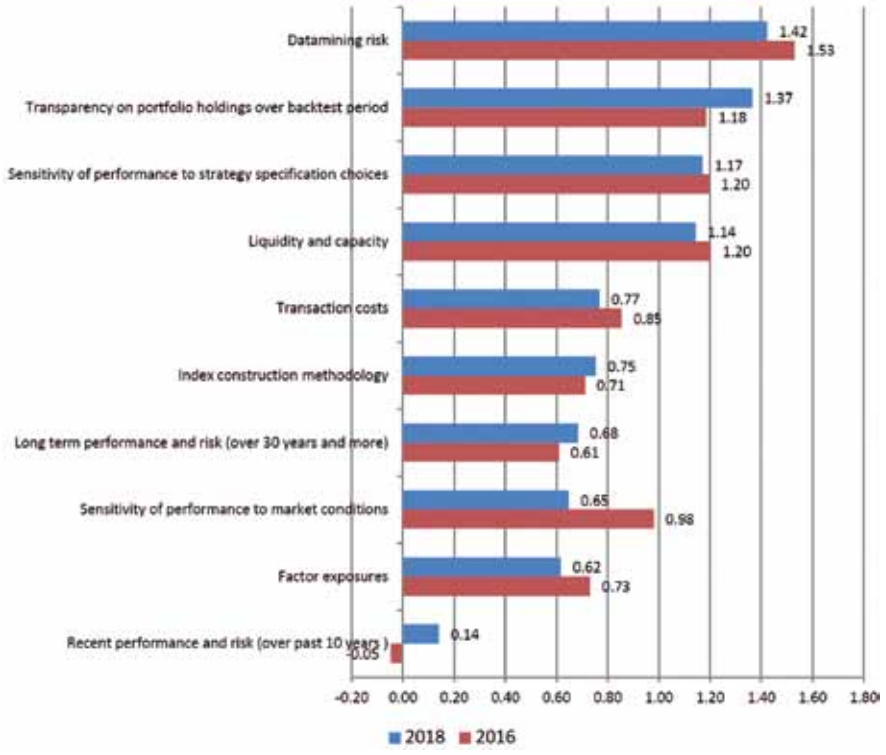
2.49. Even relatively basic information such as the index construction methodology is not judged to be easily available (score of 3.25) relative to its importance (score of 4.01). On the contrary, information about recent performance and risk over the past ten years is among the least important for respondents with a score of 3.36, but it is also one of the most easily available, exhibiting one of the highest scores (3.22) across the board in terms of availability. The gap between information importance and its accessibility as seen by investors is displayed in Exhibit 4.40.

It is interesting to note that, compared to 2016, the gap between information importance and its accessibility is perceived as narrower for most of the information. There are in particular one kind of information for which respondents perceive a considerable improvement between the importance of information and its accessibility, compared to 2016, namely the sensitivity of performance to market conditions. The gap has even been reduced by 40% since 2015. However, there are three exceptions to this improvement, namely transparency on portfolio holdings over back-test period, index construction methodology and long-term performance and risk, for which respondents perceive a wider gap than in 2016. Meanwhile, in what concerns transparency on portfolio holdings over back-test period and index construction methodology, this increase in the gap follows a perception by respondents of a considerable improvement between the importance of information and its accessibility, between 2015 and 2016.

The fact that information that is regarded as important is not considered to be easily available clearly calls into question the

Exhibit 4.40: Gap Between Information Importance and Its Accessibility
This exhibit indicates the gap between information importance and its accessibility according to investors. We also displayed 2016 results to show the evolution of results between the two years.



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information provision practices of smart beta and factor investing providers. In fact, the only area in which pronounced reduced gap exists between the importance and the ease of accessibility scores is for recent performance numbers. Performance and risk information is judged to be moderately easily available and moderately important. All other areas show more pronounced gaps between these two metrics. Moreover, there is in average a pronounced gap of 0.87 between importance of information items and their ease of accessibility, about of the same range as the one observed in 2016 (0.89). However, the means of the respective scores of importance of information items and their ease of accessibility (3.70 and 2.83, respectively), is both slightly higher than the ones perceived by respondents in 2016 (3.59 and 2.70, respectively). Overall, although there has been some improvements compared to 2016, these results suggest that there is still room for further improvement, as investors still do not believe that information considered important for assessing smart beta and factor investing strategies is made available to them with sufficient ease.

4.2.5. The Importance of Factors as Performance Drivers

The last group of questions of this section of the survey was related to the factors inherent in equity strategies and how these factors explained the performance of these strategies.

Respondents were more specifically asked about their requirements to consider the selection of a given set of factors in their investment approach. They were proposed to rate a list of factor characteristics from 0 (if the assertion was not important) to 5 (if it was absolutely crucial). The results are displayed in Exhibit 4.41. It appears that with the exception of factors should be proprietary or novel, all the other proposed characteristics receive quite high scores, ranging from 2.74 to 3.74. However, respondents are primarily concerned with the existence of extensive empirical literature documented factor premium, with a score of 3.74, closely followed by the existence of a rational risk premium with a score of 3.73, as well as by ease of implementation and low turnover and transaction costs, with a score of 3.68. The least important requirement for them is that factors should be proprietary or novel, with a score of 2.24.

Compared to 2016, it appears that there is a slight increase in all scores, showing that respondents are more and more demanding about factors. Moreover, the priorities in their requirements are consistent from one year to another, as the order does not change from one year to another.

From the results it appears that the existence of a rational explanation for factor risk premia is of principal importance to investors. This is probably related to the fact that a rational explanation suggests that the premium will be persistent. Indeed, if the literature interprets the factor premia as compensation for risk, the existence of the factor premia could also be explained by investors making systematic errors due to behavioural biases such as over- or under-reactions to news on a stock. However, whether such behavioural biases can persistently affect asset prices in the presence of some smart investors who do not suffer from these biases is a point of contention. In fact, even if the average

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investor makes systematic errors due to behavioural biases, it could still be possible that some rational investors who are not subject to such biases exploit any small opportunity resulting from the irrationality of the average investor. The trading activity of such smart investors may then make the return opportunities disappear. Therefore, behavioural explanations of persistent factor premia often introduce so-called "limits to arbitrage", which prevent smart investors from fully exploiting the opportunities arising from the irrational behaviour of other investors. The most commonly mentioned limits to arbitrage are short-sale constraints and funding-liquidity constraints. The main economic explanations for the value, momentum, low volatility and small cap factors are detailed in Amenc et al. (2015c), and those of high profitability and investment feature in Amenc et al. (2015b).

To conclude this sub-section about factors, respondents were asked about the kinds of uses they make of smart beta / factor-based exposures. They were proposed to rate a list of propositions from 0 (if they do not have this use of smart beta / factor-based exposures) to 5 (if this use of smart beta / factor-based exposures was highly frequent). The results are displayed

Exhibit 4.41: Requirements About Factors
This exhibit indicates the requirements respondents have in order to consider a given set of factors in their investment approach on a scale from 0 (not important) to 5 (absolutely crucial). We also displayed 2016 results to show the evolution of results between the two years.

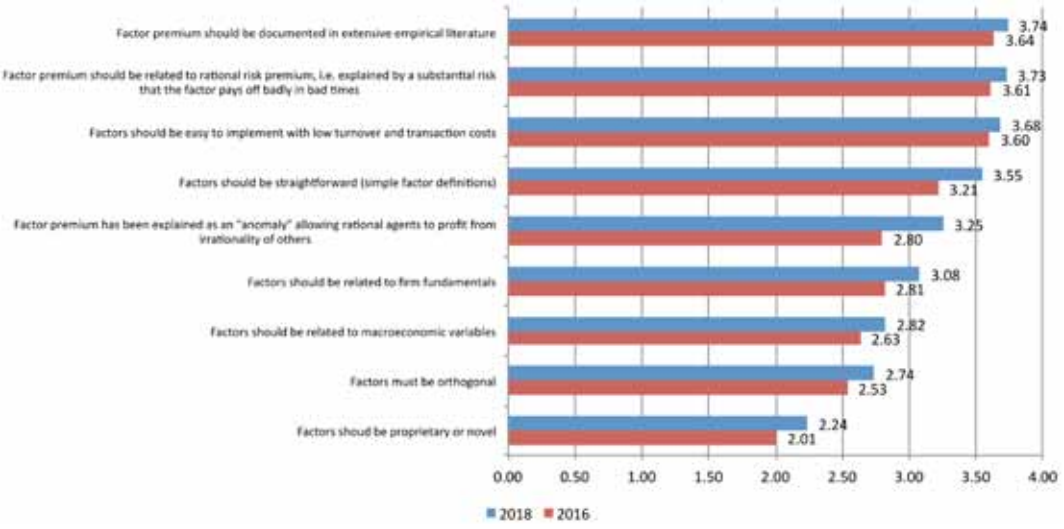
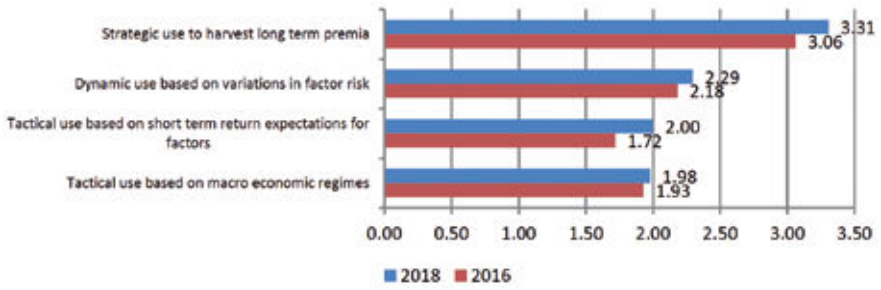


Exhibit 4.42: Use of Smart Beta / Factor-based Exposures
This exhibit indicates the use respondents make of smart beta / factor-based exposures on a scale from 0 (no use) to 5 (highly frequent use). We also displayed 2016 results to show the evolution of results between the two years.



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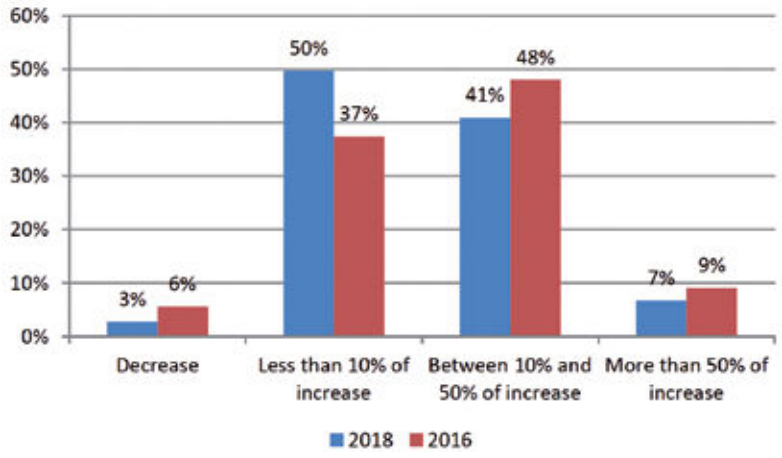
in Exhibit 4.42. It appears that, the most frequent use respondents have for smart beta / factor-based exposures is a strategic use to harvest long-term premia, with a score of 3.31. Other uses are less frequent, such as dynamic use based on variations in factor risk (2.29), tactical use based on short-term return expectations for factors (2.00) and tactical use based on macroeconomic regimes (1.98). If all scores show a slight increase compared to 2016, results remained quite similar.

4.2.6. Future Developments for Smart Beta and Factor Investing Strategies

Finally, the last group of questions in the smart beta and factor investing survey sections were dedicated to future perspectives and additional requirements for smart beta and factor investing strategies. First, respondents were asked whether or not they planned to increase their investment in smart beta or factor-based products in the near future. The results are displayed in Exhibit 4.43. It appears that a vast majority of respondents (97%) plan to increase their investment in smart beta and factor investing products over the next three years, a still higher percentage than the 94% of 2016, while only 3% of them plan to decrease it. If the majority of those who planned to increase their investment, only planned a moderate increase of less than 10% (50% of respondents, compared to 37% in 2016), more than two-fifths of respondents (41%) considered a more substantial increase of between 10% and 50% (to be compared with 48% in 2016). Only 7% of respondents thought of increasing their investment in smart beta and factor investing strategies by more than 50% (versus 9% in 2016).

These results indicate that the investment in smart beta and factor investing will increase in the coming years, not only in number of investors, as shown by the results in Exhibit 4.23, but also in terms of assets for each investor, which is not surprising as the current share of investment dedicated to smart beta and factor investing strategies is relatively restricted for a majority of respondents, as shown in Exhibit 4.24. However, if slightly more respondents plan

Exhibit 4.43: Evolution Planned for the Use of Smart Beta / Factor-based Investment Products in Terms of Assets Over the Near Future
This exhibit indicates whether respondents plan to increase or decrease their use of smart beta / factor-based investment products (in terms of assets) over the next 3 years. We also displayed 2016 results to show the evolution of results between the two years. Non-responses are excluded.



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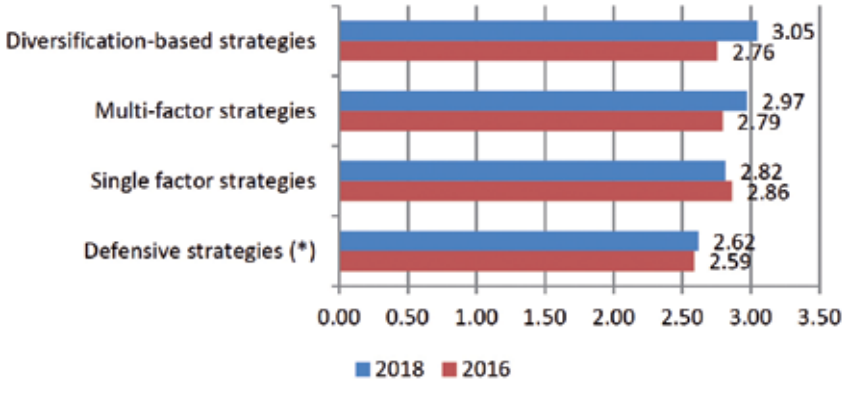
to increase their use of smart beta / factor-based investment products in the near future, compared to 2016, while at the same time planning a more moderate increase then in 2016, it may be that part of them already dedicate a share of their investment to such products that suits them, or that they still expect new developments in those products to complement their investment.

Respondents were then asked to detail the strategies they plan to use in the future. They were proposed to rate a list of strategies from 0 (if they did not plan to use it in the future) to 5 (if they planned to use it very frequently). The results are displayed in Exhibit 4.44. It appears that the average scores obtained for the four strategies were quite high and lay in a very narrow spread, from 2.62 for defensive strategies to 3.05 for diversification-based strategies. Between the two, multi-factor strategies obtained a score of 2.97 for future perspective of investment, while single-factor strategies obtained a quite similar score of 2.82. It therefore appears that respondents are aiming to diversify their new investment in smart beta and factor investing strategies across the different categories of strategies. It is interesting to note that compared to 2016, all scores have increased except the one of single-factor strategies, which was historically the most familiar to investors. The highest increase in the planning of future used is for diversification-based strategies, which is now at the top of the list, compared with a third position in 2016. This shows that respondents plan to move towards more sophisticated strategies, than single-factor strategies.

As respondents already investing in smart beta and factor investing strategies were asked to detail the wrapper they use to invest in smart beta and factor investing strategies (see Exhibit 4.26), all respondents were asked about the wrapper they planned to use in the future to invest in smart beta and factor investing strategies. The results are displayed in Exhibit 4.45. Not surprisingly, the wrapper already used by a majority (63%) of respondents, namely open-ended passive funds (ETFs and index funds) is also the wrapper respondents plan to use the most frequently in the future, with a score

Exhibit 4.44: Strategies Planned to Be Used in the Future to Invest in Smart Beta and Factor Investing
This exhibit indicates the categories of strategies respondents plan to use in the future to invest in smart beta and factor investing on a scale from 0 (never use) to 5 (use very frequently). More than one response could be given. We also displayed 2016 results to show the evolution of results between the two years. Non-responses are excluded.



(*) e.g. Minimum or low-volatility strategies

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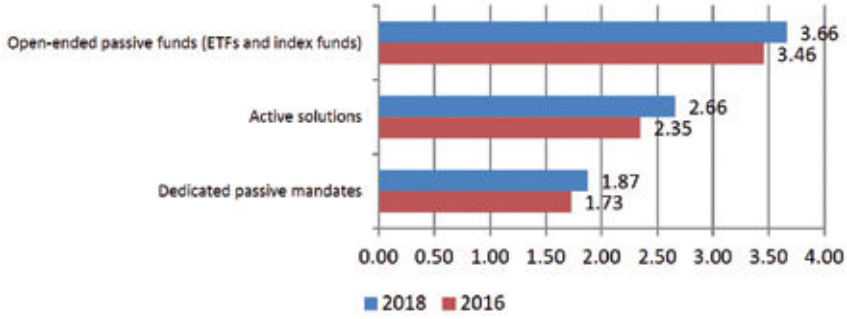
Exhibit 4.45: Wrapper Planed to Be Used in the Future to Invest in Smart Beta and Factor Investing Solutions
This exhibit indicates the categories of wrapper respondents plan to use in the future to invest in smart beta and factor investing strategies on a scale from 0 (never use) to 5 (use very frequently). We also displayed 2016 results to show the evolution of results between the two years. More than one response could be given. Non-responses are excluded.



of 3.66. The other two categories of wrapper are far behind. Active solutions, which obtain the second score for future uses, with 2.66, were also in the second position among the wrappers already used by respondents. Finally, dedicated passive mandates obtain the lowest score of 1.87 for futures uses, consistent with the lowest share of 24% of respondents using them, among those who already invest in smart beta and factor investing products. These results are quite similar to those obtained in 2016.

Respondents were then asked about their key motivations to use smart beta and factor investing strategies in the portfolio. They were proposed to rate a list of motivations from 0 (no motivation), to 5 (strong motivation). The results are displayed in Exhibit 4.46. Above all, to improve performance was the first motivation given by respondents to invest in smart beta and factor investing strategies, with a score of 3.76. Managing risk follows with a score of 3.29. Increase transparency, lower costs and managing exposure to macro risk factors came closely after with scores in the same range (3.08, 3.03 and 2.97, respectively). Finally, far behind the others, the least pressing motivation for investors to use smart beta and factor investing strategies was to address regulatory constraints, with a score of 1.52. If the first two motivations to use smart beta and factor investing strategies remain the same as in 2016, as well as the last one, small changes in the order occurred for the other three. Managing exposure to macro risk factors was downgraded from the third position to the fifth, with a slight drop in the score (2.97 versus 3.12 in 2016), in favour of increasing transparency, which exhibit the biggest increase in its score (3.08, versus 2.75 in 2016).

It is not surprising that among the motivations to invest in smart beta and factor investing strategies, improvement of performance, obtains such a high score. Smart beta and factor investing indices appear to be an alternative to investment in cap-weighted indices, which provides poor performance. Early papers by Haugen and Baker (1991) or Grinold (1992) provide empirical evidence that market-cap-weighted indices provide an inefficient risk/return trade-off. From the theoretical standpoint, the poor risk-adjusted performance of such indices should come as no surprise, as market-cap-weighting schemes are risk/return efficient only at the cost of heroic assumptions. An

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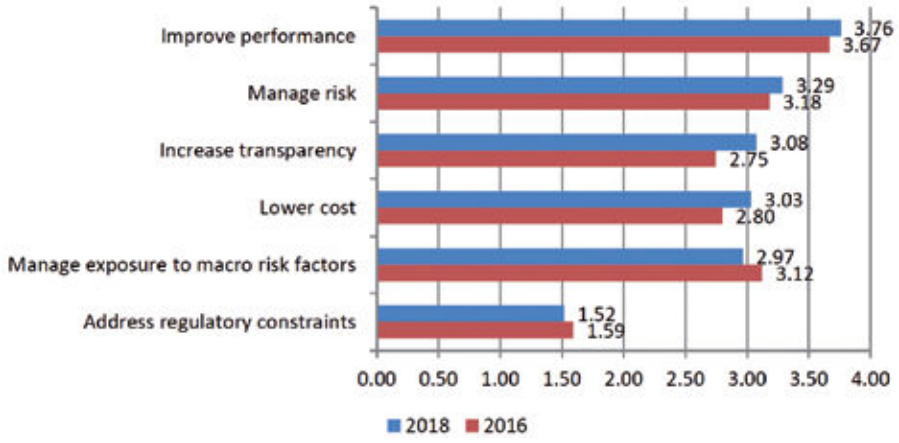
extensive body of literature has shown that the theoretical prediction of an efficient market portfolio breaks down when some of the highly unrealistic assumptions of the CAPM do not bear out. Smart beta and factor investing strategies, whose goal is to improve index efficiency, are therefore promising in terms of performance (see Amenc et al., 2010). For similar reasons, respondents perceive the management of risk as better addressed with smart beta and factor investing strategies.

The answers to this question are consistent with those provided in Section 4.2.3, where 73% respondents agreed that smart beta and factor investing indices provide significant potential to outperform cap-weighted indices in the long term, 79% of them agreed that diversification across several weighting methodologies allowed risk to be reduced and added value. 90% of them agreed that smart beta and factor investing indices require full transparency on methodology and risk analytics, and 91% of them agreed that smart beta and factor investing indices allowed factor risk premia such as value and small cap to be captured.

Respondents were also free to give additional motivations for using smart beta and factor investing strategies in the portfolio. 11 respondents (constituting about 7% of the sample) made contributions. The main arguments they gave were for diversification purposes, and to obtain a better/risk return trade-off.

Respondents were also asked about the major hurdles that prevent them from increase their use of smart beta and factor investing strategies. They were proposed to rate a list of hurdles from 0 (no hurdle), to 5 (significant hurdle). The results are displayed in Exhibit 4.47. The major hurdle appears to be the methodological issues with strategies, with a quite high score of 3.24. The lack of transparency and the dominance of cap-weighted benchmarks followed closely with a score of 2.97 and 2.75, respectively. Finally, respondents rank high costs and governance issues at the at the bottom of the list of hurdles, with about the same scores of 2.36 and 2.35, respectively. We note that none of the hurdles obtained a low score. Results are quite similar with those obtained in 2016. We note a slight scores increase for all

Exhibit 4.46: Key Motivations to Use Smart Beta and Factor Investing Strategies in the Portfolio
This exhibit indicates the key motivations to use smart beta and factor investing strategies in the portfolio on a scale from 0 (no motivation) to 5 (strong motivation). We also displayed 2016 results to show the evolution of results between the two years. More than one response could be given. Non-responses are excluded.



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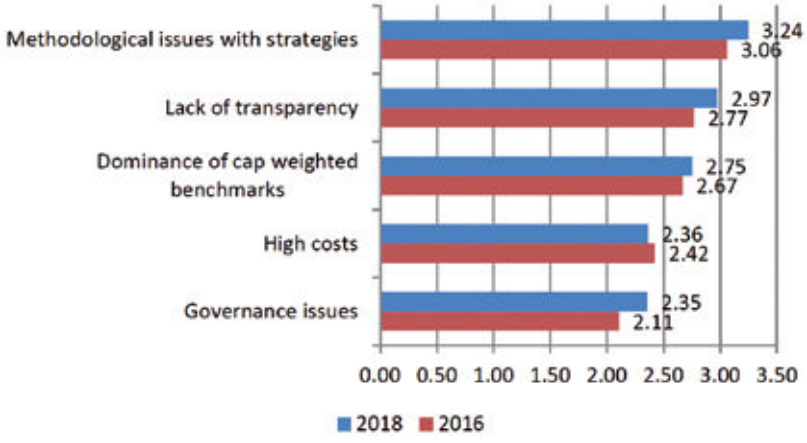
scores, with the exception of high costs, which shows that the hurdles are perceived as even more crucial than in 2016.

The fact that methodological issues and lack of transparency are the two major hurdles mentioned by investors that prevent them from using smart beta and factor investing strategies is to be put in perspective with the results shown in Exhibit 4.37, where 90% of respondents declared that smart beta and factor investing indices required full transparency on methodology and risk analytics. Respondents are not fully satisfied with the level of transparency offered by existing smart beta and factor investing products and still see room for improvement. The dominance of cap-weighted indices is the third major hurdle that prevents respondents from increasing their use of smart beta and factor investing strategies. This is a problem that is often denounced (see e.g. Arnott et al., 2010). Cap-weighted indices are still considered as the reference benchmark and it may be difficult to change this thinking.

Respondents were also free to detail additional hurdles that prevent them for increasing their investment in smart beta and factor investing strategies. 13 respondents (constituting about 8% of the sample) made contributions. The main arguments they give were related to the difficulty in communicating and explaining the relatively new concepts to managers and board members, which are non-experts, as well as a lack of clear and comprehensive information from the providers. Some respondents also mention accounting and fiscal hurdles. Others highlighted the lack of products in the sectors they want to invest in (e.g. fixed-income, currencies), given that the majority of smart beta and factor investing products are equity-related, or a lack of capacity and liquidity.

Finally, respondents were asked about the solutions they think required further product development from providers. They were proposed to rate a list of solutions from 0 (not required), to 5 (strong priority). The results are displayed in Exhibit 4.48. It appears that all the propositions obtained quite a high score, as scores ranged from 2.55 to 3.54. Among those, respondents identified the development of fixed-income smart beta and factor investing strategies

Exhibit 4.47: Major Hurdles to Increase Your Use of Smart Beta and Factor Investing Strategies in the Portfolio
This exhibit indicates the major hurdles to increase the use of smart beta and factor investing strategies in the portfolio on a scale from 0 (no hurdle) to 5 (significant hurdle). More than one response could be given. Non-responses are excluded. We also displayed 2016 results to show the evolution of results between the two years.



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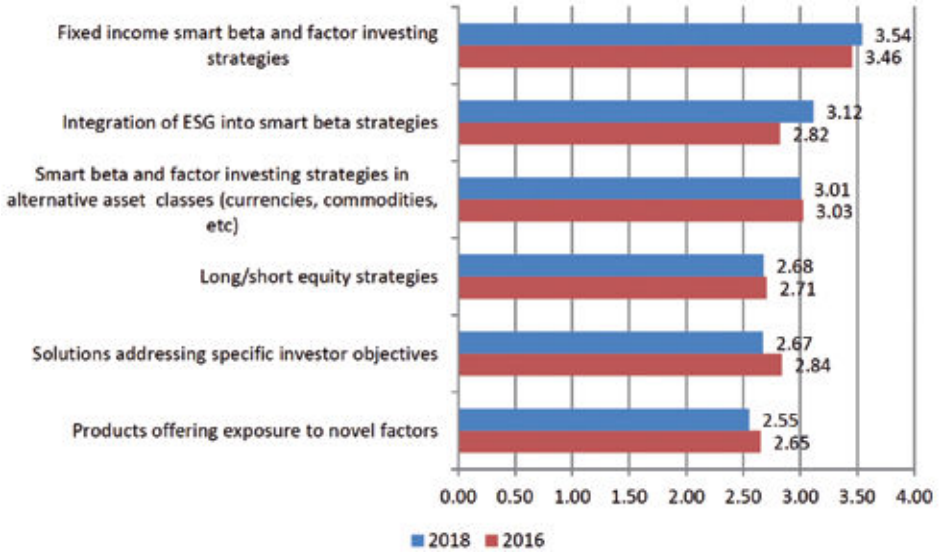
to be a priority, with a score of 3.54. This result is to be related with the ones detailed in section 4.2.2 which show an increasing interest for those products, but a still limited share devoted to it. Integration of ESG in smart beta and factor investing, and strategies in alternative asset classes (currencies, commodities, etc.), closely follow with a score of 3.12 and 3.01, respectively. The three other proposals, namely long/short equity strategies, solutions addressing specific investor objectives, and products offering exposure to novel factors, obtained scores in comparing range (2.68, 2.67 and 2.55, respectively). It is not surprising that respondents require further development in the area of fixed-income and in alternative asset classes, as smart beta and factor investing strategies were first developed for equity investment. There is consequently still a lack of products in when it comes to other asset classes and this is particularly acute for the fixed-income asset class, which is largely used by investors. This request was already at the top of the list in 2016. Integration of ESG into smart beta and factor investing strategies which ranked fourth in 2016 is now in second place in the list of products that respondents want to further developed, in front of alternative asset classes. This solution is also the one for which we observe the highest increase for further developments, compared to 2016. Alternatively, we note a slight decrease in respondent demands of development of customised solutions, which is downgraded to the fifth position in the list, compared to the third position in 2016. However, it is likely that the development of new products corresponding to investor specific objectives may lead to an even wider adoption of smart beta and factor investing solutions.

4.2.7. Trends: Use of and Satisfaction with Smart Beta and Factor Investing Strategies Over Time

Over the recent years, smart beta and factor investing strategies have undergone considerable development and are increasingly used by investors, as shown in the present survey. As most of the

Exhibit 4.48: Which Type of Solutions Do You Think Require Further Product Development from Providers?
This exhibit indicates the types of solutions requiring further products developments from providers on a scale from 0 (not required) to 5 (strong priority). More than one response could be given. Non-responses are excluded. We also displayed 2016 results to show the evolution of results between the two years.



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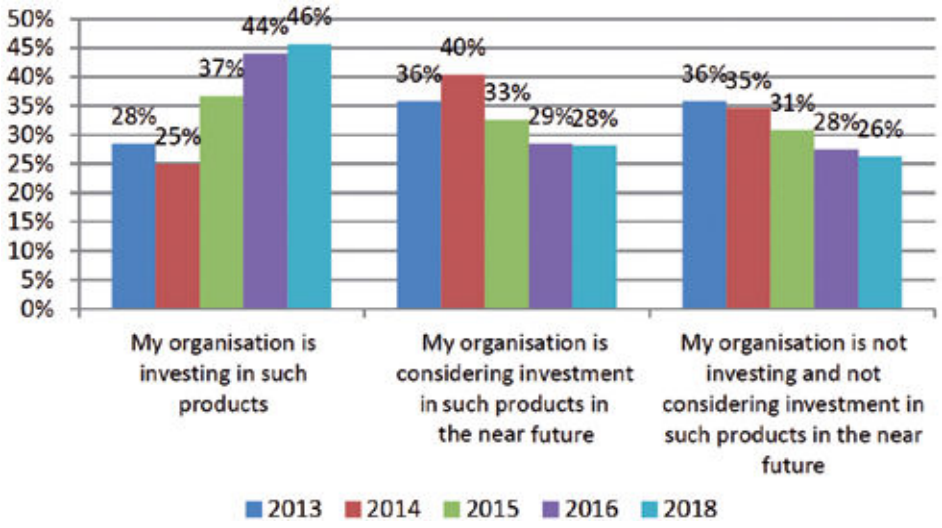
questions presented in this section were first introduced last year, the comparison of results obtained over the last five years will mainly focus on the perception respondents have of smart beta and factor investing indices.

Exhibit 4.49 shows an increasing trend in the number of smart beta and factor investing product investors. Since 2013, the increase has been of 57%. From one year to another, we also see that the cumulative percentages of those who are already investing in smart beta and factor investing products and those who are considering investment in such products in the near future has been constantly increasing from 64% in 2013, to 74% in 2018, showing a constant decline in the proportion of respondents who are not considering investment in such products in the near future.

Exhibit 4.50 summarises the opinions of respondents invited to comment on the distinctive characteristics of smart beta and factor investing indices compared to the cap-weighted indices over five years. It appears that as soon as 2013, a vast majority of respondents (at least three-quarters of them) were already convinced of the advantages smart beta and factor investing indices provide in terms of performance gains, index deconcentration and risk reduction, compared to cap-weighted indices. We therefore do not observe a dramatic increase over the five years in the proportion of respondents who have a favourable opinion of smart beta and factor investing index characteristics, since very high proportions of respondents had already identified the advantage of smart beta and factor investing indices since they were first included in the survey. This favourable opinion was confirmed in the following years, even slightly progressing with regard to the opinion that smart beta and factor investing indices allow factor risk premia such as value and small cap to be captured (86% of respondents agreed with it in 2013, versus 91% in 2018). It was also confirmed with regard to the opinion that diversification across several weighting

Exhibit 4.49: Use of Products That Track Smart Beta and Factor Investing Indices
This exhibit indicates the percentages of respondents that reported using products that track smart beta and factor investing indices. Non-responses are excluded. The percentages for 2013 to 2016 are based on the results of the EDHEC ETF survey from 2013 to 2016.



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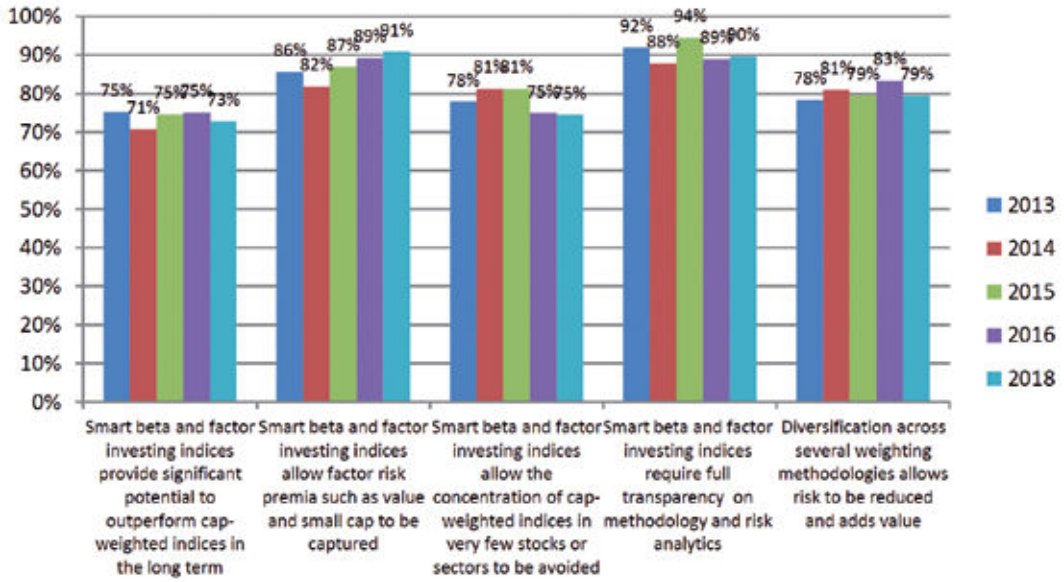
methodologies allowed risk to be reduced and added value (78% of respondents agreeing with it in 2013, versus 79% in 2018).

Respondents also have requirements concerning smart beta and factor investing indices. Since 2013, about 90% of them think that smart beta and factor investing indices require full transparency on methodology and risk analytics. While slight variations around this value have been observed over the years, there is still a large consensus among investors about this requirement, indicating that respondents are still not satisfied with the current level of smart beta and factor investing index transparency. Transparency is not only the best protection against the risks arising from conflicts of interests, but it is also instrumental in improving the informational efficiency of the indexing industry. In view of the increased diversification and sophistication of the rapidly growing indexing industry, achieving informational efficiency should be a key priority. While transparency is important for market indices (i.e. indices that aim to represent a given market or segment), it is all the more so for smart beta and factor investing indices. Indeed, while these new forms of indices can provide investors with improved risk-reward profiles or other benefits, they bring distinct risks of their own. Unfortunately, these indices' low level of transparency, which is routinely justified by the use of proprietary models, makes the evaluation of risks difficult.

Exhibit 4.50: Agreement of Respondents With Statements About Smart Beta and Factor Investing Indices
This exhibit indicates the percentage of respondents that agree or strongly agree with the statement about smart beta and factor investing indices. Non-responses are excluded. The percentages for 2013 to 2016 are based on the results of the EDHEC ETF survey from 2013 to 2016.



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Amundi is Europe's largest asset manager by assets under management and ranks in the top 10[1] globally. It manages more than 1.46 trillion[2] euros of assets across six main investment hubs[3]. Amundi offers its clients in Europe, Asia-Pacific, the Middle-East and the Americas a wealth of market expertise and a full range of capabilities across the active, passive and real assets investment universes. Headquartered in Paris, and listed since November 2015, Amundi is the 1st asset manager in Europe by market capitalization[4].

Leveraging the benefits of its increased scope and size, Amundi has the ability to offer new and enhanced services and tools to its clients. Thanks to its unique research capabilities and the skills of close to 4,500 team members and market experts based in 37 countries, Amundi provides retail, institutional and corporate clients with innovative investment strategies and solutions tailored to their needs, targeted outcomes and risk profiles.

1 - Source IPE "Top 400 asset managers" published in June 2018 and based on AUM as of end December 2017.
2 - Amundi figures as of June 30, 2018
3 - Investment hubs: Boston, Dublin, London, Milan, Paris and Tokyo
4 - Based on market capitalization as of June 30, 2018

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Founded in 1906, EDHEC is one of the foremost international business schools. Operating from campuses in Lille, Nice, Paris, London and Singapore, EDHEC is one of the top 15 European business schools. Accredited by the three main international academic organisations, EQUIS, AACSB, and Association of MBAs, EDHEC has for a number of years been pursuing a strategy of international excellence that led it to set up EDHEC-Risk Institute in 2001. This Institute boasts a team of permanent professors, engineers and support staff, and counts a large number of affiliate professors and research associates from the financial industry among its ranks.

The Need for Investment Solutions and Risk Management

Investment management is justified as an industry only to the extent that it can demonstrate a capacity to add value through the design of dedicated and meaningful investor-centric investment solutions, as opposed to one-size-fits-all manager-centric investment products. After several decades of relative inertia, the much needed move towards investment solutions has been greatly facilitated by a true industrial revolution triggered by profound paradigm changes in terms of (1) mass production of cost- and risk-efficient smart factor indices; (2) mass customisation of liability-driven investing and goal-based investing strategies; and (3) mass distribution, with robo-advisor technologies. In parallel, the investment industry is strongly impacted by two other major external revolutions, namely the digital revolution and the environmental revolution.

In this fast-moving environment, EDHEC-Risk Institute positions itself as the leading academic think-tank in the area of investment solutions, which gives true significance to the investment management practice. Through our multi-faceted programme of research, outreach, education and industry partnership initiatives, our ambition is to support industry players, both asset owners and asset managers, in their efforts to transition towards a novel, welfare-improving, investment management paradigm.

EDHEC-Risk New Initiatives

In addition to the EDHEC Alternative Indexes, which are used as performance benchmarks for risk analysis by investors in hedge funds, and the EDHEC-IEIF Monthly Commercial Property index, which tracks the performance of the French commercial property market through SCPIs, EDHEC-Risk has recently launched a series of new initiatives.

- The EDHEC-Princeton Retirement Goal-Based Investing Index Series, launched in May 2018, which represent asset allocation benchmarks for innovative mass-customised target-date solutions for individuals preparing for retirement;

- The EDHEC Bond Risk Premium Monitor, the purpose of which is to offer to investment and academic communities a tool to quantify and analyse the risk premium associated with Government bonds;

- The EDHEC-Risk Investment Solutions (Serious) Game, which is meant to facilitate engagement with graduate students or investment professionals enrolled on one of EDHEC-Risk's various campus-based, blended or fully-digital educational programmes.

Academic Excellence and Industry Relevance

In an attempt to ensure that the research it carries out is truly applicable, EDHEC has implemented a dual validation system for the work of EDHEC-Risk. All research work must be part of a research programme, the relevance and goals of which have been validated from both an academic and a business viewpoint by the Institute's advisory board. This board is made up of internationally recognised researchers, the Institute's business partners, and

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representatives of major international institutional investors. Management of the research programmes respects a rigorous validation process, which guarantees the scientific quality and the operational usefulness of the programmes.

Seven research programmes have been conducted by the centre to date:
- Investment Solutions in Institutional and Individual Money Management;
- Equity Risk Premia in Investment Solutions;
- Fixed-Income Risk Premia in Investment Solutions;
- Alternative Risk Premia in Investment Solutions;
- Multi-Asset Multi-Factor Investment Solutions;
- Reporting and Regulation for Investment Solutions;
- Technology, Big Data and Artificial Intelligence for Investment Solutions.

EDHEC-Risk Institute's seven research programmes explore interrelated aspects of investment solutions to advance the frontiers of knowledge and foster industry innovation. They receive the support of a large number of financial companies. The results of the research programmes are disseminated through the EDHEC-Risk locations in the City of London (United Kingdom) and Nice, (France).

EDHEC-Risk has developed a close partnership with a small number of sponsors within the framework of research chairs or major research projects:
- **Financial Risk Management as a Source of Performance,**
in partnership with the *French Asset Management Association (Association Française de la Gestion financière – AFG)*;
- **ETF, Indexing and Smart Beta Investment Strategies,**
in partnership with *Amundi*;
- **Regulation and Institutional Investment,**
in partnership with *AXA Investment Managers*;
- **Optimising Bond Portfolios,**
in partnership with *BDF Gestion*;
- **Asset-Liability Management and Institutional Investment Management,**
in partnership with *BNP Paribas Investment Partners*;
- **New Frontiers in Risk Assessment and Performance Reporting,**
in partnership with *CACEIS*;
- **Exploring the Commodity Futures Risk Premium: Implications for Asset Allocation and Regulation,**
in partnership with *CME Group*;
- **Asset-Liability Management Techniques for Sovereign Wealth Fund Management,**
in partnership with *Deutsche Bank*;
- **The Benefits of Volatility Derivatives in Equity Portfolio Management,**
in partnership with *Eurex*;
- **Innovations and Regulations in Investment Banking,**
in partnership with the *French Banking Federation (FBF)*;
- **Dynamic Allocation Models and New Forms of Target-Date Funds for Private and Institutional Clients,**
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- **Risk Allocation Solutions,**
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- **Infrastructure Equity Investment Management and Benchmarking,**
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- **Risk Allocation Framework for Goal-Driven Investing Strategies,**
in partnership with *Merrill Lynch Wealth Management*;
- **Financial Engineering and Global Alternative Portfolios for Institutional Investors,**
in partnership with *Morgan Stanley Investment Management*;
- **Investment and Governance Characteristics of Infrastructure Debt Investments,**
in partnership with *Natixis*;
- **Advanced Investment Solutions for Liability Hedging for Inflation Risk,**
in partnership with *Ontario Teachers'* Pension Plan;
- **Cross-Sectional and Time-Series Estimates of Risk Premia in Bond Markets,**
in partnership with *PIMCO*;
- **Active Allocation to Smart Factor Indices,**
in partnership with *Rothschild & Cie*;
- **Solvency II,**
in partnership with *Russell Investments*;
- **Advanced Modelling for Alternative Investments,**
in partnership with *Société Générale Prime Services (Newedge)*;
- **Structured Equity Investment Strategies for Long-Term Asian Investors,**
in partnership with *Société Générale Corporate & Investment Banking*.

The philosophy of the Institute is to validate its work by publication in international academic journals, as well as to make it available to the sector through its position papers, published studies and global conferences.

To ensure the distribution of its research to the industry, EDHEC-Risk also provides professionals with access to its website, https://risk.edhec.edu, which is devoted to international risk and investment management research for the industry. The website is aimed at professionals who wish to benefit from EDHEC-Risk's analysis and expertise in the area of investment solutions. Its quarterly newsletter is distributed to more than 150,000 readers.

Research for Business

EDHEC-Risk Institute also has highly significant executive education activities for professionals, in partnership with prestigious academic partners. EDHEC-Risk's executive education programmes help investment professionals upgrade their skills with advanced asset allocation and risk management training across traditional and alternative classes.

In 2012, EDHEC-Risk Institute signed two strategic partnership agreements. The first was with the Operations Research and Financial Engineering department of Princeton University to set up a joint research programme in the area of investment solutions for institutions and individuals. The second was with Yale School of Management to set up joint certified executive training courses in North America and Europe in the area of risk and investment management.

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As part of its policy of transferring know-how to the industry, in 2013 EDHEC-Risk Institute also set up ERI Scientific Beta, which is an original initiative that aims to favour the adoption of the latest advances in smart beta design and implementation by the whole investment industry. Its academic origin provides the foundation for its strategy: offer, in the best economic conditions possible, the smart beta solutions that are most proven scientifically with full transparency in both the methods and the associated risks.

EDHEC-Risk Institute also contributed to the 2016 launch of EDHEC Infrastructure Institute (EDHEC*infra*), a spin-off dedicated to benchmarking private infrastructure investments. EDHEC*infra* was created to address the profound knowledge gap faced by infrastructure investors by collecting and standardising private investment and cash flow data and running state-of-the-art asset pricing and risk models to create the performance benchmarks that are needed for asset allocation, prudential regulation and the design of infrastructure investment solutions.

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EDHEC-Risk Institute Publications and Position Papers (2015-2018)

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