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EDHEC-Risk Institute

Research Insights

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Introduction
Noël Amenc

It is my pleasure to introduce the latest issue of the Research Insights supplement to IPE, which aims to provide European institutional investors with an academic research perspective on the most relevant issues in the industry today.

We report on the results of a survey of European institutional investors conducted by EDHEC-Risk Institute on their perceptions and expectations with respect to the governance and transparency of indices. The survey shows that institutional investors are not particularly impressed by the current level of transparency in the indexing industry and reveals that end-users strongly support higher standards of index transparency.

The EDHEC-Risk European ETF Survey 2013 tells us that satisfaction with ETFs has remained at high levels across most asset classes. There have been increases in satisfaction for corporate bond, commodity, real estate and sector ETFs, but satisfaction rates for ETFs based on the most liquid ETF asset classes are far more consistent compared to those based on illiquid asset classes. Product development within certain asset classes has driven increases in ETF usage, notably within the real estate, hedge fund and infrastructure asset classes. More than a quarter of respondents already use products tracking 'smart beta' indices and more than an additional one-third of respondents are considering investing in such products in the near future.

We present a major review of the academic literature on high frequency trading. This review leads us to conclude that algorithmic trading has direct effects on market quality that are both desirable (increased liquidity for larger stocks and better price discovery) and undesirable (less liquidity in small caps and higher volatility for all stocks). Algorithmic trading also affects broader economic measures, again with desirable (lower co-movement of market variables) and less desirable (new equity capital is more difficult to access) results. This wide range of effects calls for a measured approach to regulation that considers all parties that have an interest in well-functioning equity markets.

In the realm of equity factor investing, we examine two particular issues pertaining to factor investing: the role of country indices in building a globally-diversified portfolio of market, value, size and momentum premia, and whether a dynamic portfolio strategy based on predictions of future risk could be used to avoid periods of low returns and high volatility in factor premia.

We look at the link between idiosyncratic volatility and returns in commodity futures markets by using various pricing models as benchmarks to extract the idiosyncratic volatility signal. We find that the abnormal performance of active strategies that systematically exploit idiosyncratic volatility is an illusion created by the choice of an inappropriate benchmark that fails to account for backwardation and contango.

Finally, we look to improve traditional risk parity strategies by considering more appropriate risk measures than historical volatility. Whereas the standard approach to risk parity is used to design a well-diversified strategy, a new generation of risk parity strategies is emerging that considers more sophisticated risk measures and incorporates expected return inputs. These novel approaches are better adapted to react to changes in interest rate and/or risk premium levels.

We hope that the articles in the supplement will prove useful and informative. We wish you an enjoyable read and extend our warmest thanks to our friends at IPE for their collaboration on the supplement.

Noël Amenc, Professor of Finance, EDHEC Business School, Director, EDHEC-Risk Institute, CEO, ERI Scientific Beta

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Index transparency: a survey of European investors' perceptions, needs and expectations

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Between August and November 2013, EDHEC-Risk Institute surveyed institutional end-investors across Europe on their perceptions and expectations with respect to the governance and transparency of indices. The survey's 109 respondents include Europe's largest pension and reserve funds, insurance and provident institutions and their asset management subsidiaries. Hailing from 20 countries and dependencies, respondents collectively provide protection to hundreds of millions of scheme participants and clients in Europe and beyond. To the best of our knowledge, this is the first survey of this scale giving the opportunity for end-users to have their voices heard in a debate that is being held in their name.

In the context of the recent consultations on the regulation of financial benchmarks, index providers have petitioned regulators to curtail transparency requirements, explaining that they were not aware of any transparency issue across the industry, that they already had strong incentives to offer the best transparency to the market and that the provision of more granular information would not only be useless to investors but could also be potentially harmful to them.

The survey documents that end-users are not particularly impressed by the current level of transparency in the indexing industry – only about a third of respondents are very (4.6%) or somewhat (30.3%) satisfied with it – and shows that investors strongly support higher standards of index transparency.

In particular, the survey results reveal:

- Majority support for more, rather than less, regulation of the index business, with circa twice as many respondents regarding new regulation as necessary rather than excessive.
- A concern about conflicts of interest across the index provision sector and the rejection of fine distinctions based on the sources of data or control structure of the index provider: only a small minority (16.5%) of respondents accept the contention that equity indices calculated from observable transaction prices are not at threat from conflicts of interest; a majority of respondents (62.4%) consider that conflicts of interest are broader than those arising from the ownership or control structure of a provider and only about a quarter agree with conventional representations that 'independent' index providers are largely free from conflicts of interest (22%) or that 'self-indexing' is inherently and materially more prone to these conflicts (4.6%).
- Strong confidence in transparency, rather than governance, as the best mitigator of potential conflicts of interest: an overwhelming majority of respondents (85.2%) identify transparency as the best mitigator of conflicts of interest and only 12% view good index governance as sufficient to deal with these conflicts.
- A strong desire to be able to conduct detailed due diligence on index concepts on the basis of full transparency of methodologies, index levels and constituent data: close to nine out of 10 respondents (88.1%) support the clarification of index concepts through clear disclosure of the objectives of indices and the identification of metrics that allow them to measure the extent to which these objectives have been achieved; furthermore end-investors demand a level of transparency at least on a par with that required by the European Securities and Markets Authority (ESMA) for the eligibility of indices in the undertakings for collective investment in transferable securities (UCITS) framework and they reject as insufficient the minimum transparency guaranteed by the International Organisation of Securities Commissions (IOSCO) – 79.8% of respondents consider that the adequate level of index transparency is one allowing for historical (43.1%) or historical and live (36.7%) replication and only a tiny number (2.8%) are satisfied with disclosures designed to impart an understanding of the objectives and key construction principles of indices.
- Very strong support (70.6% vs 21.1%) for the proposal that ESMA's transparency rules should be extended to non-UCITS products and mandates.
- Majority support (56.5% vs 25%) for the proposal that intermediaries that incorporate indices into their solutions should be required to perform due diligence on the quality and transparency of these indices (as is required from UCITS).
- Overwhelming support (73.4% vs 11.9%) for complimentary, non-discriminatory and unrestricted usage of index information for purposes of research and evaluation.
- A strong conviction that the rise of strategy indices makes transparency even more important (77.1% vs 11%) and that opacity undermines the credibility of reported track records (80.8% vs 17.4%), in particular for new forms of indices.

"The survey documents that end-users are not particularly impressed by the current level of transparency in the indexing industry and shows that investors strongly support higher standards of index transparency"

These results reinforce EDHEC-Risk Institute's commitment to and advocacy of higher standards of transparency for indices, up to a level allowing for their independent replication, on a historical and non-commercial basis. 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 (ie, indices that aim to represent a given market or segment), it is all the more so for strategy indices (ie, indices that aim to achieve a given risk-return objective). 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. Few investors have the access to information and wherewithal to analyse the risks and benefits of these innovations or even verify the integrity of the simulated track records which are used to advertise them.

In this context, complimentary, non-discriminatory and unrestricted access to index methodologies and historical information about index levels, constituents and weightings (for purposes of evaluation and research) is a precondition to informational efficiency in the market and informed decision-making by investors. Transparency should not be something to be monetised through the engineering of opacity as it is a precondition to the proper selling and the suitable uses of indices. Opacity typically increases the scope for conflicts of interest to play out as abuse and intensifies the risks of adverse selection, whereby informational asymmetry between providers and users causes low-quality products to be incentivised and high-quality offerings to be discouraged: without sufficient transparency, the riskiest and least robust indices will thrive as long as they promise the highest performances, the lowest costs or the easiest implementation. Opacity also practically denies the public the ability to verify the integrity of index track records, gauge the quality of offerings, assess the relevance and suitability of indices and integrate them into a modern risk and investment framework. Transparency would greatly leverage market discipline as a means of accountability, not only reducing the risks of abuse, but also promoting the design, offering and adoption of indices that enhance the welfare of investors.

EDHEC-Risk Institute considers that adequate market information would facilitate access to innovative indices that offer the possibility of democratising 60 years of financial research and generating significant long-term welfare gains for investors. At the same time, such transparency would provide support for the long-term, sustainable growth of the indexing industry, to the benefit of index providers and investment managers. Making minor adjustments to the business models of index providers to accommodate the informational needs of investors and accepting an open debate on indices would be a small price to pay in the short term. In this context, EDHEC-Risk Institute sees transparency not as a threat to the indexing industry – as some short-sighted index providers have contended – but instead as a powerful lever for integrity, progress, innovation and development in this industry. It is in the interest of investors, and in the long-term interest of the passive management industry, that regulators oppose rather than officially condone the engineering of opacity and the silencing of dialogue around innovations.

This survey shows that investors are not satisfied with the status quo on transparency promoted by the majority of index providers and enshrined in the July 2013 IOSCO Principles for Financial Benchmarks (IOSCO, 2013). As the latter influences are visible in the ongoing discussions on the proposal for a regulation on indices used as benchmarks, it is important to underline that, while a majority of investors welcome new European regulation in the area, investors regard a governance-based approach as largely irrelevant and instead show overwhelming support for a strengthening and extension of the transparency advances introduced by ESMA in the context of its 2012 Guidelines on ETFs and Other UCITS Issues (ESMA, 2012). Currently, these guidelines are only applicable to UCITS and only partially applied by index providers. A rapid inspection of a sample of indices used by index-tracking UCITS and other indices offered by the world's leading index providers documents a low level of index provider compliance with the spirit of the ESMA guidelines (even considering only the provisions of paragraphs 55 and 56 for simplicity).

"Adequate market information would facilitate access to innovative indices that offer the possibility of democratising 60 years of financial research and generating significant long-term welfare gains for investors"

With respect to the appropriate information of potential users of indices, EDHEC-Risk Institute also reaffirms that it considers it key that transparent and informative track records be provided to all interested parties when indices are being marketed. The use of simulated performance should not be tolerated when index providers fail to provide the market with the information required to verify the integrity of these back-tested results – this includes full transparency on the index methodology in the back-test period and the full history of constituents and weightings, which together allow for replication of the reported performances.

To limit the gaming of the back-tests that the choice of a convenient window allows and to provide relevant information on the risk-return profile of the index in different market environments, regulators should require that any back-test be performed over a standard, long-term, period. Finally, index providers should be required to warn users clearly when back-tested performance is being presented and describe how possible differences in back-tested versus live methodologies could affect future index performance.

In this regard, we find a lot of merit in the strict conditions set forth by the US Financial Industry Regulatory Authority (FINRA) to regulate the use of pre-inception performance data for the marketing of exchange-traded products to institutional investors (FINRA, 2013) and recommend the imposition of similar rules in Europe whenever simulated performance is used to market indices. Notable restrictions on the use of back-tested performance data imposed by FINRA include limitation to systematic indices; transparency of assumptions, rules and criteria in sufficient detail as to permit replication of the performance using readily-available market data; minimum history of 10 years of pre-inception data; as well as clear labelling and separation from actual performance record.

Opacity should not be tolerated by regulators as blanket protection against intellectual property infringements or, in the context of indexing, be presented as a way of protecting the interests of investors. A governance-based approach to the regulation of indices entrenching the current opacity of the industry would not only be at best largely ineffective at dealing with the risks arising from conflicts of interest, and possibly counterproductive, but it would also strengthen the existing oligopoly in the index provision industry with adverse consequences for competition and innovation. Such an approach is recognised as ineffective by investors and as costly by asset managers.

Providing the public with the information required to independently replicate an index for research and evaluation purposes should not be misrepresented as denying index providers the right to protect and enforce their intellectual property rights or as threatening the economic viability of the index provision industry. On the one hand, there are legal and contractual tools to defend index providers against the unauthorised use of their methodologies and data. On the other hand, index providers have proven apt at growing their revenues by optimising licensing terms and moving from selling access to data to licensing the multiple usages of the same data; providing transparency for the purpose of research and evaluation would in no material way limit the ability of index providers to charge for other usages of the same data or different index data. There is simply no serious justification to excuse the current opacity in the indexing industry.

In this context, EDHEC-Risk Institute calls upon European lawmakers to seize the opportunity of the ongoing discussions on the proposal for a regulation on indices used as benchmarks to introduce standards of transparency that will address the legitimate information needs of index users and leverage market discipline to efficiently reduce the risks of abuse and promote competition and innovation in the indexing industry.

"Providing the public with the information required to independently replicate an index for research and evaluation purposes should not be misrepresented as denying index providers the right to protect and enforce their intellectual property rights or as threatening the economic viability of the index provision industry"

EDHEC-Risk Institute also reiterates its warning against the costs and dangers of a non-market-based governance approach to the regulation of benchmarks. The internal controls and governance provisions of the proposed European regulation create costs which directly and indirectly reduce the welfare of investors: directly, because compliance costs and the costs associated with the liabilities for non-compliance are eventually borne by investors and, indirectly, because these costs create barriers to entry in the industry and promote market concentration, which restricts competition and can lead to high prices and reduced innovation. This orientation favours an oligopolistic market structure of the sort which in the past never guaranteed against scandals but instead guaranteed that any scandal had systemic proportions.

Furthermore, while history illustrates the recurrent failure of governance-based approaches at preventing major scandals, the general public may not fully appreciate their futility, which could lead to heightened risks of abusive conduct, especially if stricter governance rules justified continued opacity. Indeed, certification effects, in particular those involving an official sanction by the regulator, promote a false sense of confidence based on the idea that governance rules and regulatory oversight resolve conflicts of interest issues and guarantee integrity. This in turn de-incentivises due diligence efforts on the part of product providers, advisers and end-users and increases moral hazard – ie, the willingness to take risks whose costs are expected to be borne by or shared with others. This tendency to rely on the certification provided by the regulator on the basis of an ineffective risk mitigation mechanism is all the more dangerous when a lack of transparency simultaneously skews choice towards the riskiest and least robust indices.

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The EDHEC European ETF Survey 2013

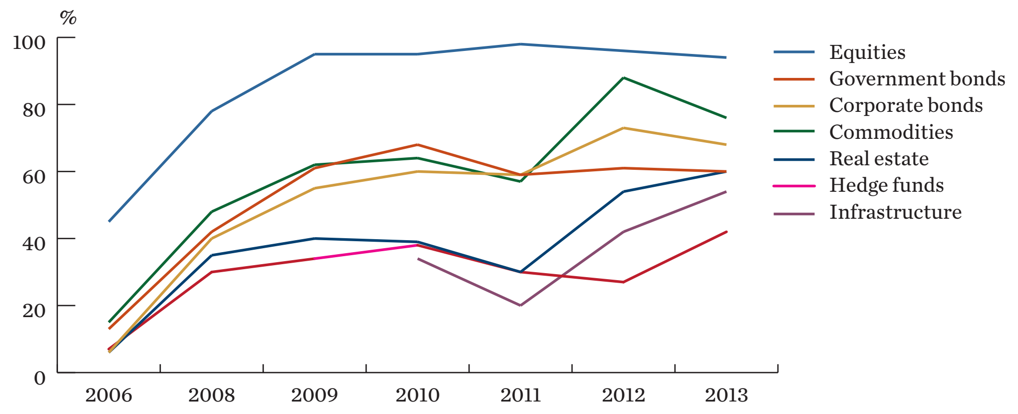
Frédéric Ducoulombier, Associate Professor of Finance, EDHEC Business School and Director, EDHEC Risk Institute–Asia; **Felix Goltz**, Head of Applied Research, EDHEC-Risk Institute; **Véronique Le Sourd**, Senior Research Engineer, EDHEC-Risk Institute; **Ashish Lodh**, Senior Quantitative Analyst, EDHEC-Risk Institute

The aim of the EDHEC European ETF Survey 2013, produced by EDHEC-Risk Institute with the support of Amundi ETF & Indexing, was to analyse the usage of exchange-traded funds (ETFs) in investment management and to give a detailed account of the current perceptions and practices of European investors in ETFs. The industry has undergone rapid growth since inception. The first ETFs appeared in the US in 1989 and they started trading in Europe in 2000. Assets under management (AUM) of ETFs and other exchange-traded index products in Europe amounted to $395bn as at the end of 2013 (ETFGI, 2014).

There are a number of studies on the ETF industry in Europe. A key advantage of employing a survey methodology is that we obtain direct information from market participants concerning not only which instruments they currently use, but also how these instruments fit into their overall investment process, and how they are evaluated. Moreover, in addition to current usage, we are able to harness information concerning future plans of investment professionals, thus providing an outlook of likely future industry developments.

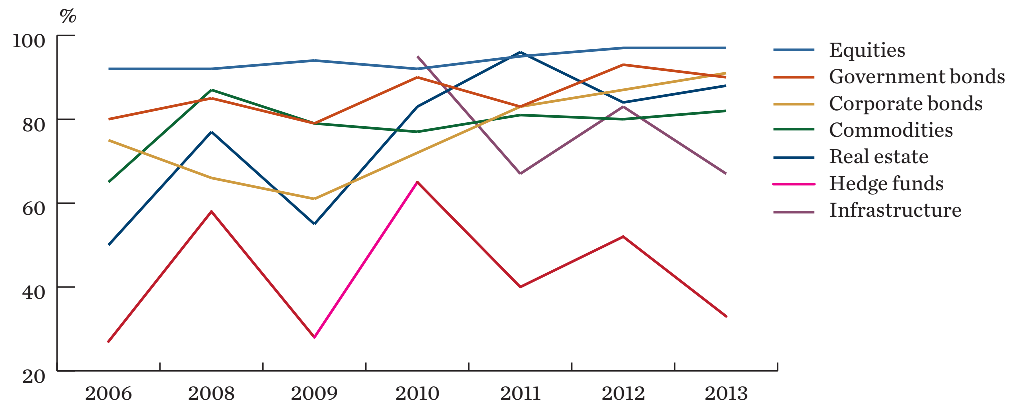
To summarise the main findings of the study, we will first explain key survey results on the rates of usage and satisfaction with ETFs. We then look at how ETFs are integrated into the investment process and for what purposes they are being used. To address a recent development in the industry, our survey assessed the views investors have about ETFs tracking smart beta indices, which we also summarise below. Finally, we analyse investor expectations of their future use of ETFs and their requests for further product development, which provides some hints with regard to the outlook for the ETF industry.

1. Use of ETFs or ETF-like products over time



This figure indicates the use of ETFs or ETF-like products for different asset classes over time. The percentages are based on the results of EDHEC ETF survey 2006, 2008–13.

2. Satisfaction with ETFs or ETF-like products over time



This figure 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 EDHEC ETF survey 2006, 2008–13.

Continuing growth in the ETF market

While ETF usage is no longer growing at previously seen rates, product development within certain asset classes has driven increases in ETF usage. Figure 1 illustrates significant increases in rates of ETF usage in 2013 within the asset classes of real estate (5.8% increase), hedge funds (14.8% increase) and infrastructure (14.8% increase).

The increased usage of infrastructure ETFs seems likely due to an increase in the range of ETF products available to infrastructure investors. This may be due to the recent emergence of more 'specialised' infrastructure ETF products. For instance, investors are now able to gain infrastructure exposure to individual geographic regions through ETFs whereas previously ETFs could only provide 'global' infrastructure exposure. Hence it would seem that continuing innovation within the industry is perpetuating increased usage of ETFs within certain asset classes.

High satisfaction with ETFs

Satisfaction has remained at high levels across most asset classes as shown in figure 2. There have been increases in satisfaction for corporate bond, commodity, real estate and sector ETFs. This may also be linked to the fact that there has been an increase in product variety for these asset classes resulting in a product that is more likely to satisfy investor requirements.

Of all asset classes, satisfaction with equity ETFs has been the highest and the most consistent over the last seven years. Aside from the greater variety of products, another reason for the consistently high satisfaction rates within equities may be the fact that they have the longest history hence investors are most familiar with their advantages and their drawbacks. This could also be related to the highly liquid nature of the underlying equity asset class compared to other types of ETFs.

Indeed, we can see from figure 2 that satisfaction rates for ETFs based on the most liquid

ETF asset classes are far more consistent compared to those based on illiquid asset classes. For instance, hedge fund and real estate ETFs have exhibited variation in satisfaction rates between 30% and 60%, and 50% and 95% respectively over the last seven years. In contrast we can see that equity and government bond ETF satisfaction rates have been consistently in the region of 90% and 80% respectively. This may be due to the fact that two of the key attractions of ETFs are their liquidity and relatively low levels of mispricing, both of which are determined by the liquidity of the underlying assets. It is worth noting that there has been a constant increase in the satisfaction rate with corporate bond ETFs, rising from about 60% in 2009 to about 90% in 2013. This increase in the satisfaction rate is observed as product variety for corporate bond ETFs has been increasing strongly over the past years and corporate bond ETFs are increasingly used by investors to diversify portfolios that are heavily exposed to sovereign debt (see Goltz, Le Sourd, Mukai and Rachidy [2013]). It is likely that investors – given the increasing variety of corporate bond ETFs – are better able to select an appropriate ETF which may explain the rise in satisfaction.

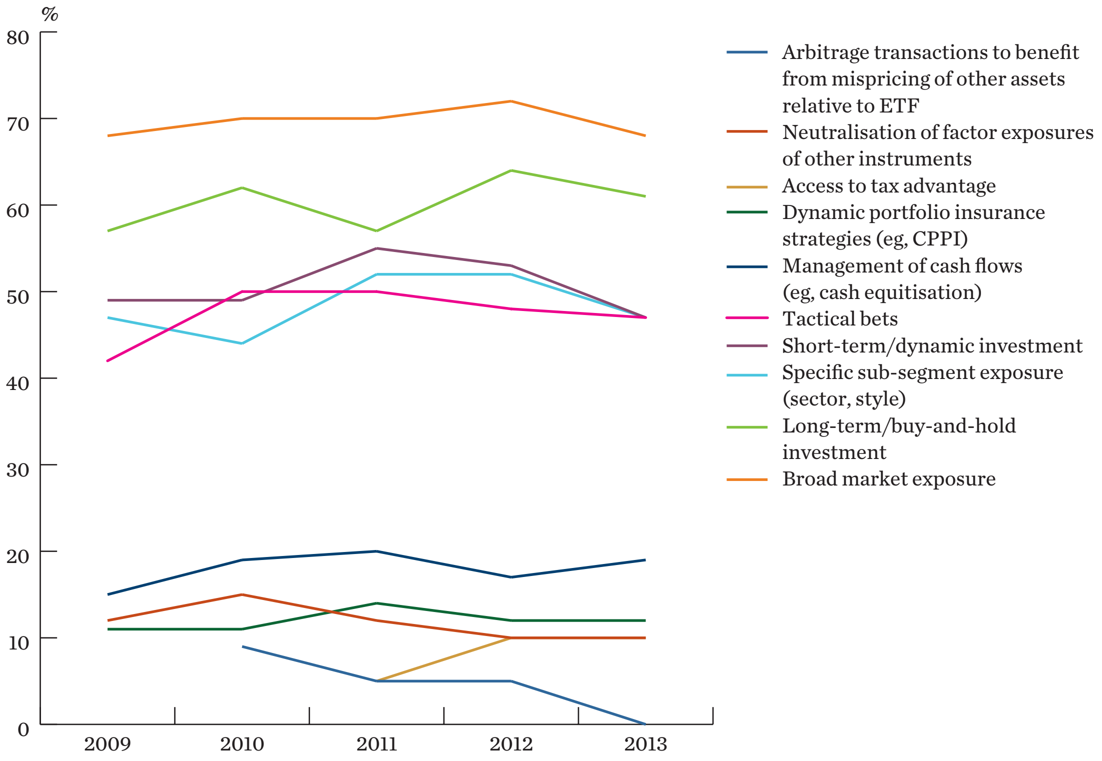
ETFs in the investment process

ETFs are an important instrument in the investment process. 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, gain access to specific segments of the market through ETFs on sectors or styles. Beyond such broad categorisations of use, we also assess how often ETFs are used for specific purposes such as neutralising factor exposures or arbitraging related assets.

Figure 3 shows the percentages of respondents that frequently use ETFs for different purposes and the trend of this usage over time, beginning in 2009. The results show that the frequent use of ETFs by about 70% of respondents to gain broad market exposure is a constant trend over time from 2009. If around 60%, on average, use ETFs to obtain buy-and-hold investments over the period starting in 2009, more variations are observed from one year to another than in the use for broad market exposure. Over time, the use of ETFs to obtain short-term (dynamic) investments, specific sub-segment exposure or for tactical bets is frequent for around 50% of respondents, with a slight decrease for these three uses in 2013, compared to 2012. Other uses of ETFs are more rare: the use of ETFs for management of cash flows is frequent for a percentage of respondents ranging from 15% to 20% over time; the use of ETFs for neutralisation of factor exposures related to other investments and dynamic portfolio insurance strategies is frequent for a percentage of respondents ranging between 10% and 15% over time; the frequent use of ETFs to access tax advantages is capped at 10% of respondents; and the use of ETFs for capturing arbitrage opportunities has shown a constant decrease since 2009.

These results show that investment in ETFs is mainly associated with a long-term exposure to broad market indices, a trend observed in successive surveys. Still, over time, frequent use of around 50% of ETFs for short-term exposure and for specific market sub-segments exposure indicates that other investment purposes are also important for respondents. This is not a surprising result given the fact that the liquidity, low cost and product variety benefits of ETFs make them viable tools for such purposes.

3. Frequent use of ETFs for the following purposes over time



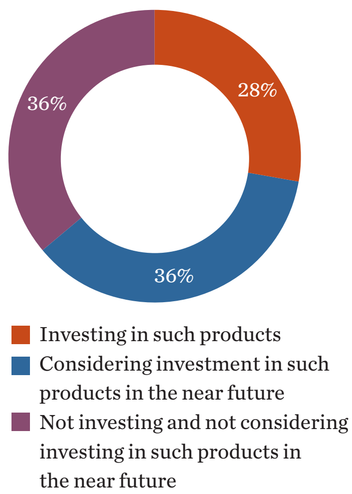
This figure indicates the percentages of respondents frequently using ETFs for each of the mentioned purposes over time. Respondents were asked to rate the frequency from 1 to 6. Category 'frequent' would include ratings from 4 to 6. The percentages are based on the results of ETF survey 2009–13 (The question was not asked in the survey before 2009).

Perceptions about smart beta ETFs

In view of the considerable development in new forms of indices, in this 2013 survey we asked investors about their use and perception of ETFs tracking smart beta indices. It appears from the results that more than a quarter (28%) of respondents already use products tracking smart beta indices and that more than an additional one-third of respondents (36%) are considering investing in such products in the near future (see figure 4). These results show that investors have significant interest in these products.

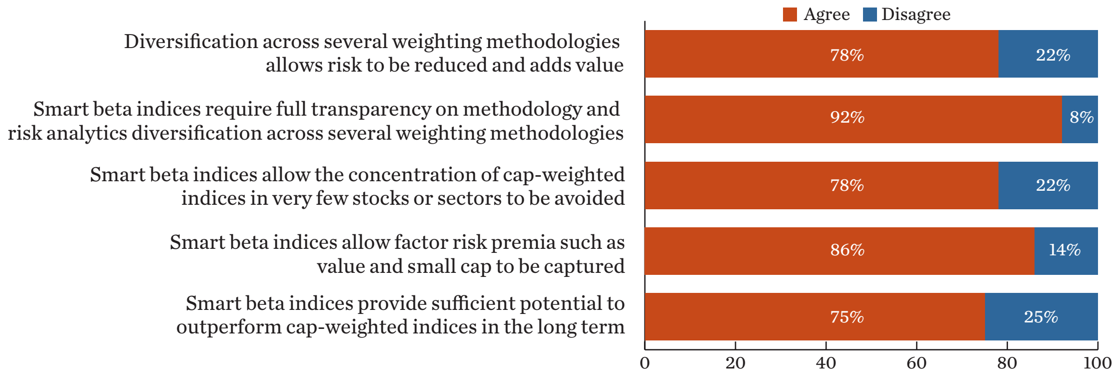
This broad use of ETFs based on smart beta indices is explained by the favourable perception that respondents have of smart beta indices as tools for improving their investment process (see figure 5). As shown by figure 5, at least three quarters of respondents think that smart beta indices provide significant potential to outperform cap-weighted indices in the long term and that they avoid cap-weighted indices being concentrated in very few stocks or sectors. The same proportion of respondents thinks that

4. Use of products tracking smart beta indices



This exhibit indicates the percentages of respondents that reported use of products tracking smart beta indices. Non responses are excluded.

5. Agreement of respondents with statements about smart beta indices



This exhibit indicates the percentages of respondents that agree or strongly agree with the statements about smart beta indices. Non responses are excluded.

◄ the diversification across several weighting methodologies allows risk to be reduced and adds value, while 86% of respondents agree that smart beta indices allow factor risk premia, such as value and small-cap, to be captured. Interestingly, an even greater share of respondents (92%) agrees that smart beta indices require full transparency on methodology and risk analytics diversification across several methodologies.

Strong outlook for ETF usage versus other indexation products

We ask survey respondents whether they invest in alternatives to ETFs, such as futures, total return swaps (TRS) and index funds, and ask them to rate ETFs and their alternatives according to various criteria. The responses are shown in figure 6 and allow for a few general conclusions. First, in terms of liquidity, transparency, and cost, ETFs are considered advantageous, although on some criteria they are less well regarded than futures. Second, ETFs are ranked highest for available range of indices and asset classes. Therefore, European investors and asset managers seem to be well aware of the diversity of ETFs, which has grown dramatically in recent years. Third, futures are the most serious alternative to ETFs, but ETFs are perceived as superior with regard to minimum subscription, operational constraints, and the tax and regulatory regime. Therefore, it appears that implementation concerns with futures (such as margin calls, and applying exact allocations even for small portfolios) give ETFs an advantage. Fourth, respondents believe that ETFs generally perform much better than TRS.

Overall, we find that ETFs and futures receive the highest scores among the four products (2.38 and 2.43, respectively), while total return swaps receive the lowest score of 1.86. For individual criteria, ETFs are rated as outstanding in terms of ease of use, product range, minimum subscription and operational constraints.

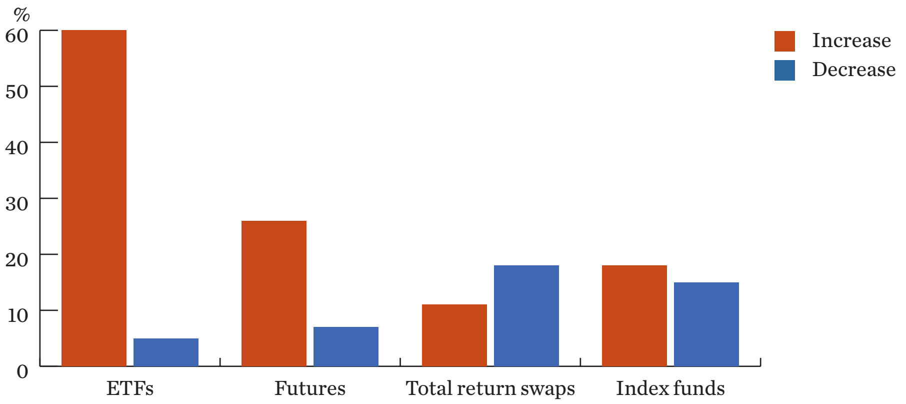
Interestingly, when we examine respondents' answers with regard to their future use of each of the above indexation vehicles, we see that the results are broadly reflective of the quality scores assigned to the indexation vehicles by respondents. Hence investors' detailed analysis of each indexation vehicle is in line with their predictions of future use. For instance, figure 7 shows us that most respondents (60%) are planning to increase their investments in ETFs, while only 5% of investors plan a decrease. Similarly, we can see that 26% of respondents are planning to increase their use of futures, compared to just 7% planning to decrease their usage of the product. However, the situation is much more balanced for index funds, which came in third place in terms of an overall quality score, with approximately the same number of investors planning an increase as there are planning a decrease (18% and 15% respectively).

6. Summary of scores for ETFs, futures, total return swaps and index funds

Quality	ETFs	Futures	Total return swaps	Index funds
Liquidity	2.40 (97.7%)	**2.78** **(86.8%)**	1.77 (69.0%)	2.25 (85.1%)
Cost of liquidity	2.18 (96.6%)	**2.68** **(85.6%)**	1.80 (69.5%)	2.07 (82.2%)
Other cost	2.31 (97.7%)	**2.48** **(85.1%)**	2.36 (69.5%)	2.30 (84.5%)
Tracking error	2.24 (97.7%)	**2.62** **(85.1%)**	1.80 (70.1%)	2.07 (84.5%)
Product range	**2.67** **(97.1%)**	1.98 (84.5%)	2.12 (96.1%)	2.03 (85.1%)
Transparency	2.33 (97.1%)	**2.65** **(84.5%)**	1.97 (71.3%)	2.21 (83.9%)
Minimum subscription	**2.71** **(96.6%)**	2.09 (85.1%)	1.60 (71.3%)	2.21 (84.5%)
Operational constraints	**2.57** **(97.1%)**	2.10 (84.5%)	1.53 (71.8%)	2.31 (84.5%)
Regulatory regime	2.41 (93.7%)	**2.49** **(81.6%)**	1.72 (70.7%)	2.47 (82.8%)
Tax regime	**2.17** **(89.7%)**	**2.25** **(80.5%)**	2.14 (68.4%)	2.17 (81.6%)
Control of counterparty risk	2.16 (95.4%)	**2.59** **(98.3%)**	1.62 (70.7%)	2.27 (84.5%)
Average score	*2.38*	*2.43*	*1.86*	*2.27*

This table indicates the average scores which the four products received from respondents based on the 11 criteria. For each particular quality, grade 1 to 3 were given for answers of poor to very good and the average score was calculated based on the number of responses that have rated that question. The familiarity percentages were obtained by using (1- non-responses). The numbers highlighted in bold indicate the highest score.

7. How do you predict your future use of the following instruments?

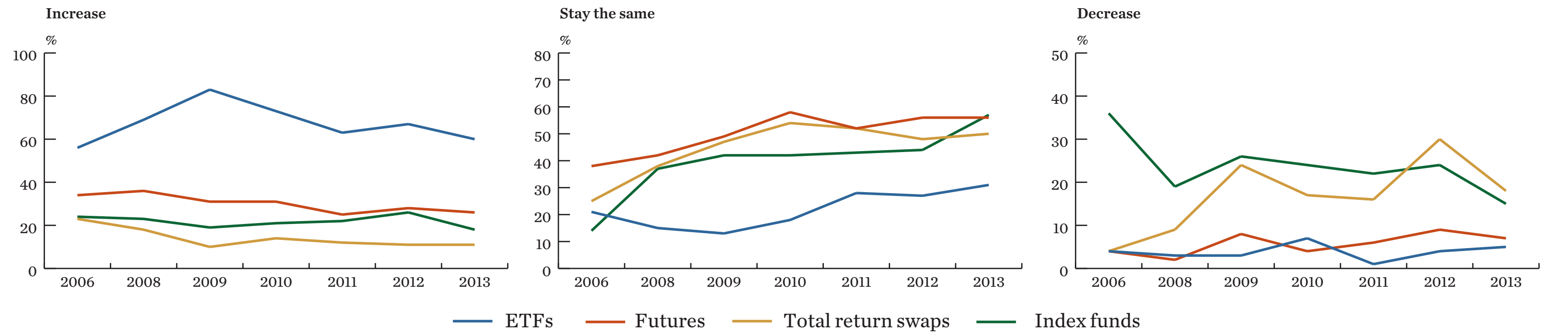


This figure indicates the respondents' forecast about the future use of each of the mentioned products. Non-responses to this question are reported as 'no answer' so that the percentages for all categories in each product add up to 100%.

For TRS, which came in last in terms of an overall quality score, we can see that the outlook in terms of future usage is much more negative, with only 11% of investors planning an increase in usage compared to 18% of investors planning a decrease. Thus in comparison to other indexation vehicles, we can see that ETFs have the brightest future in terms of usage.

Finally, we compare the investors' expected usage of these products over time. The results are shown in figure 8. The results suggest that despite the past growth and increasing maturity of the ETF market, ETF investors are still looking to increase or at least to maintain their use of ETFs and have a more favourable outlook of their use of ETFs than of their use of alternative indexing products.

8. Will you increase your use of the following indexing products?



This exhibit indicates the future potential to change each of the mentioned products by investors over time. The percentages are based on the results of EDHEC ETF survey 2006, 2008–13.

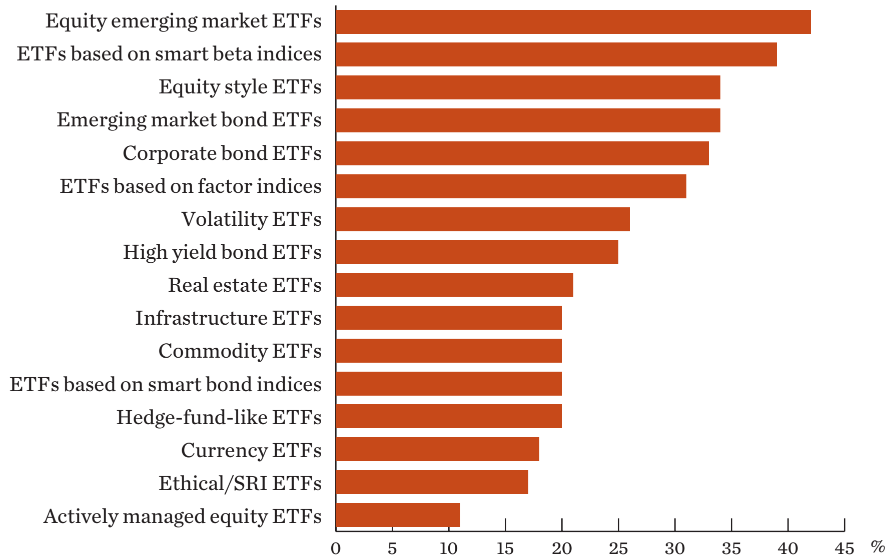
Demand for new product development

Figure 9 ranks the different ETF product types in order of descending demand for product development in 2013. We can see that the area of most interest to respondents is the emerging markets equities segment, with 42% of respondents wanting to see further product development in this asset class. Emerging equity ETFs have been at the top of the investors' wish list for many of our past surveys, suggesting that there is ample room for product innovation in this area. This persistent finding may be explained by the fact that emerging equity ETFs are still mainly based on broad global, regional or country emerging market indices with relatively little choice available to obtain specific sector or style exposures within the emerging market equity universe.

We can also see that there is increasing interest among investors in development of ETFs based on alternative forms of indices, with 39% of investors interested in further development in ETFs based on smart beta indices. This percentage is slightly higher than last year (37% in 2012). This result is interesting as there has been a considerable number of product launches in the area of smart beta ETFs. The fact that investors see room for further product development despite the numerous product launches may be explained by the focus of product launches on relatively few popular strategies, representing a small number of risk premia such as the value premium and defensive equity strategies.

Given the increasing discussion on harnessing multiple factor premia from equity investing, including factors such as momentum, size, quality among others, it is perhaps not surprising that investors see room for further product development. Indeed, ETFs based on style indices or factor indices (with 34% and 31% respectively) are also among the most widely requested categories for future product development.

9. What type of ETF products would you like to see developed further in future?



This figure indicates how many respondents would like to see further development in the future for different ETF products. Respondents are able to choose more than one product.

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Algorithmic trading: conclusions from academic studies

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By most accounts, algorithmic trading (AT) represents most of the trading volume in today's markets. Algorithms emit orders and cancellations, decide where and when to send orders and what quantities to offer for trading. Much of AT constitutes high frequency trading (HFT), which refers to flow that reacts within milliseconds or faster to market updates or other new information. Primarily because of their overall importance in terms of trading volume, but also because HFT strategies are (still) neither transparent nor well understood, there is substantial public policy interest in the effects that HFT has on other market participants, their trading strategies, the quality of markets and the prevalence of systemic risk.

During the last 10 years, information technology and market structures have developed into an arena that facilitates, promotes and rewards fast, automated trading. The availability of efficient platforms to implement AT strategies is a precondition for HFT and has led to exponential growth in HFT volume, especially in the North American and European equity markets. While AT and HFT are not the same, more AT will generally imply more HFT. One reason for this is that HF traders compete to interact with agency algorithms, either to supply liquidity or to create short-term alpha (see Hasbrouck and Saar [2011]).

Because of the fast growth and the large market share of HFT, security market regulators around the world actively debate whether and, if so, how HFT should be regulated, and place increasing scrutiny on algorithmic and high frequency order submission strategies and their consequences. Despite this debate and a recent flurry of theoretical and empirical work in this area, many questions remain unanswered. In this article, we review the recent literature that has begun to study the costs and benefits associated with AT and HFT.

AT is not a recent phenomenon, but its intensity and especially the speed at which it is conducted has experienced precipitous growth over the past 15 years. Indeed, one fundamental question is whether AT makes markets different in any way than they were, say, 10 years ago, or whether AT just lets markets move faster without any real differences in the underlying economic processes. Only in the former case would there be a more pronounced need for regulatory scrutiny, if there is one at all. No market participants are forced on to trading platforms that are populated by algo traders. Therefore, if AT increases the trading costs of some participants, we would expect these participants to switch to other venues. The problem in measuring such migration, changes in market quality and other potential effects of more intense AT is that cause and effect are difficult to differentiate.

Despite being a young literature, analyses of HFT and algorithmic trading reveal an interesting dichotomy. Several theoretical and empirical models analyse HFT's effects on market quality measures, including execution costs, volatility and informational efficiency. While theoretical models mostly predict negative (or mixed) consequences of having fast traders in the market, the average effects estimated in empirical results tend to be positive.

Related theory

Cartea and Penalva (2011) design a model with liquidity traders, market makers and HFT. They find that HFT increases overall trading volume, but also volatility and the price impact of liquidity traders. Market makers come out ▸

◄ even – they lose market share (and thus revenues) for liquidity provision to the HFT, but are compensated with higher rewards for their remaining liquidity supply. The cost for the higher rewards to market making, and for the greater revenues to HFT, are all borne by the liquidity traders. McInish and Upson (2011) arrive at similar conclusions using a different mechanism. In their model, strategic fast traders are the first to learn about quote updates and use this privileged information to trade at stale prices with slow traders. Here, too, HFT activity increases trading costs for (slow) liquidity traders. In Jarrow and Protter's (2011) model, HF traders also observe order-flow information faster than other traders. They show that when demand curves are downward sloping, HFT activity affects price and creates a temporary mispricing that HFT can profitably exploit. In this case, the detrimental effect lies in less efficient pricing in addition to a transfer from slow to fast traders.

A similar wealth transfer arises in an earlier model by Brunnermeier and Pederson (2005). They allow traders to follow order anticipation strategies ('predatory trading' in their model), a strategy that requires the ability to predict order flow in real time at high frequency and is easily implemented as a trading algorithm. Order anticipators attempt to predict large uninformed orders and then trade ahead of these orders, in the same direction. This increases the costs for the large liquidity trader, who will end up trading at relatively inferior prices, perhaps even with the order anticipator. Brunnermeier and Pederson show that this leads to price overshooting and that it withdraws liquidity from the market when it is most needed (by the large trader). As a result, a wealth transfer occurs from the large liquidity trader to the order anticipator. Moreover, they show that the low-liquidity event can trigger systemic liquidity shocks for other traders and markets, thereby multiplying the negative consequences the order anticipator imposes on the market.

The models discussed so far generally predict higher costs to uninformed and/or slow liquidity traders in the form of a greater price impact and pre-trade information leakage. Greater execution costs essentially involve a wealth transfer from slow to fast traders, but this does not necessarily have welfare implications. Several recent papers address these welfare issues. Philippon and Pagnotta (2011) examine exchanges' choice to invest in fast-trading technology and traders' order submission and participation decisions. Allowing market structure and speed to arise endogenously, they show that outcomes are generally inefficient relative to the efficient outcome where all venues break even. Depending on the market structure, in equilibrium participation is too low and, in some cases, trading speed is suboptimal. Hoffman (2013) extends Foucault's (1999) limit order market and allows algorithmic (fast) and human (slow) traders to compete. Traders can endogenously choose to invest in fast-trading technology. Being fast means that traders can react to news first, which reduces the risk of their limit orders being picked off after adverse price moves. In this model, the welfare effect of introducing algorithmic traders depends on the level of market efficiency. Investments in fast technology improve welfare when efficiency is sufficiently high, but it reduces welfare when efficiency is too low. Biais, Foucault and Moinas (2010) show that HFT can generate gains either from trade or from adverse selection, which would arise from their faster access to information. But a social planner would only consider gains from trade, not from adverse selection. As a result, HF traders overinvest in technology, which leads to socially undesirable outcomes. Overall, existing theoretical models agree that HFT has undesirable consequences for liquidity traders, informational efficiency and volatility, and these effects may well result in lower social welfare. Finally, Jovanovic and Menkveld (2011) also study welfare implications of high frequency trading. In their model, middlemen intermediate between fast limit order and slow market order traders. Depending on parameter values, their entry may increase or decrease trading volume, and also has a mixed effect on welfare.

Empirical studies

The recent spread of HFT has spurred a number of empirical studies that examine its consequences. Their inferences are easiest to synthesise by first categorising the type of data that each study uses. Ideally, one would have identification of trader accounts, which in turn would allow researchers to observe each trader's strategy across stocks and over time. Two studies have access to this type of data for index e-mini futures. Kirilenko et al (2011) look at e-minis trading around the flash crash of 6 May 2010. Baron, Brogaard and Kirilenko (2012) show that HFT in S&P 500 e-minis is quite profitable. But to date, there is no academic study of equity trading that uses data where the researcher can directly identify trader-level order submission strategies and their consequences for algorithmic or HF traders, either over time or across stocks.

"Overall, existing theoretical models agree that HFT has undesirable consequences for liquidity traders, informational efficiency and volatility, and these effects may well result in lower social welfare"

To create proxies for AT intensity, researchers follow one of two approaches: infer the portion of algo/HF trading from intraday data; or use data where HF traders are identified as a group. We discuss advantages and disadvantage of both approaches below. The most basic approach uses standard intraday transactions data and either develops proxies for HF traders, or infers their actions from the speed with which traders react to market events. On the downside, these approaches may not exactly capture AT because it must be inferred from the data with potentially unknown consequences for the quality of inference. But the advantage of these approaches is that they permit construction of broad and long panels that allow fairly general inferences. For many applications, the breadth and length of the resulting panel outweighs the concerns about using a proxy. Hendershott, Jones and Menkveld (2011) and Boehmer, Fong and Wu (2013a, 2013b) use message counts as a proxy for AT activity. Alternative approaches also exist. Hasbrouck and Saar (2011) and Egginton, VanNess and VanNess (2010) infer HFT activity from periods of apparent high frequency activity. The former identify episodes of orders that react within milliseconds to market updates. The latter examine high-activity intervals, defined as one-minute periods where the quote-per-minute count exceeds a historical average by 20 standard deviations (and the trading day as a whole is not too different, defined as being less than two standard deviations away from the mean).

The second category of data provides summary information about the type of trader. For example, Brogaard (2010, 2011a, 2011b) and Hendershott and Riordan (2011) use a 2008–09 Nasdaq sample that summarises the aggregate order flow generated by 26 HFT firms. These firms capture about three quarters of trading volume in the sample stocks. Here, the advantage is that actual HFT can be observed for a random sample of 120 stocks. Potential drawbacks include the selection of HFT firms, which have been picked by the exchange that provided the data and, additionally, have been willing to have their order flows disclosed to academics. Because HF strategies are typically considered sensitive both from a legal and competitive perspective, this selection process could conceivably result in orders that are more benign than a random sample of HFT orders.[1]

In summary, the broadest data, which in principle would allow the strongest inferences, make the least clear distinction between HF, algorithmic and slow trading. At the other extreme, data sets that identify actual HF activity tend to be either small or not necessarily representative for other reasons. Moreover, some of these available data sets are subject to endogeneity concerns, because it is generally not easy to identify whether causality goes from market quality to HFT activity, or from HFT activity to market quality.

Against these basic data concerns, most but not all results document positive effects of HFT/AT on liquidity and price efficiency. Hendershott, Jones and Menkveld (2011) show that algorithmic trading is associated with better liquidity and faster price discovery. They use the 2003 introduction of autoquote at the NYSE as an instrument to establish causality from algorithmic trading to market quality improvements. Brogaard (2010, 2011a, 2011b) uses the 2008–09 Nasdaq sample of 26 HFTs and shows ambiguous effects on volatility, but improvements in liquidity. Based on HFT activity inferred from millisecond-level responses, Hasbrouck and Saar (2011) find improvements in volatility, spreads, and depth when these fast traders are active. Using the same data as Brogaard, Hendershott and Riordan (2011) document that HFT plays an important role in price discovery. Additionally, for a much smaller Deutsche Börse sample, Hendershott and Riordan (2009) find that algorithmic trading makes prices more informative. Finally, Malinova, Park and Riordan (2013) show that a reduction in HFT reduces liquidity and profits for retail traders in the Canadian market.

On the negative side, Kirilenko et al (2011) argue that HFT worsened (but did not cause) the 6 May 2010 flash crash. Dichev, Huang and Zhou (2011) find that trading per se generates excess volatility, suggesting that HFT can lead to undesirable levels of volatility. Hasbrouck and Saar (2009) are the first to document the 'fleeting' nature of many limit orders in electronic markets, and question the traditional view that limit orders provide liquidity to the market. This argument raises questions about the quality or usefulness of HFT-provided liquidity that is often quite short-lived with

1 The sample used by Hendershott and Riordan (2009) also falls into this category but it is not subject to a selection concern. They use a short sample of exchange-classified algorithmic trades at Deutsche Börse. Also similar is Menkveld's (2010) sample, who uses brokerage identities to infer the trades by a single HFT in the European market. These samples allow inferences about algos and HFT, respectively, but are limited to relatively narrow samples.

availability periods sometimes measured in milliseconds. Consistent with this concern, Egginton, VanNess and VanNess (2011) show that periods of extremely active quoting behaviour are associated with degraded liquidity and elevated volatility. Importantly, they show that such episodes are surprisingly frequent. While there are good economic reasons for such quote-bunching to occur as a benign by-product of HF liquidity provision, as Hasbrouck and Saar (2011) argue, it is also possible that it arises as a consequence of intentional 'quote stuffing'. This practice involves submitting a large volume of messages to disguise trading strategies. Gai, Yao and Ye (2013) show that quote stuffing has negative effects on trading and argue that there are no offsetting social benefits. McInish and Upson (2011) examine trading around quote changes and compare fast and slow responses. They find that fast traders strategically leave stale orders on the book and that slow traders often interact with these at prices that are inferior to those available elsewhere. Such 'structural strategies' (see SEC [2010] for a discussion) exploit wealth transfers among traders and may not have off-setting market-quality implications. Interestingly, Hirschey (2013) finds that the profits of HFT are most easily explained by their ability to predict other traders' order flow. Such order anticipation trading transfers wealth among market participants and is thus unlikely to improve welfare. Finally, Chaboud et al (2009) look at HFT in the foreign exchange market and document that the correlation among algorithmic 'machine' orders is much higher than the correlation among 'human' orders. This raises questions regarding the contribution of algorithms to the transmission of systemic risk.

Given this state of the literature, Boehmer, Fong and Wu (2013a) make two observations. First, the generally positive picture of AT emerging from the empirical evidence does not seem consistent with the generally negative expectation arising from theoretical work in this area. Moreover, the empirical evidence is not in agreement either. While many studies find that algorithmic and HF traders appear to increase liquidity and price discovery, others raise concerns about the quality of liquidity, AT's effect on volatility and about disparities between traders' response times that suggest a wealth transfer from slow to fast traders. More recent studies, including Gai, Yao and Ye (2013) and Hirschey (2013), show explicitly that certain AT strategies are costly to some traders and have no offsetting social benefit.

In the first study of AT in an international context, Boehmer, Fong and Wu (BFW [2013a]) use a broad sample that covers more than 20,000 stocks, 10 years and 39 stock markets. They find that greater AT intensity is, on average, associated with more liquidity, faster price discovery and greater volatility. These results control for share price, trading volume, market capitalisation, and volatility (where appropriate) and the results are remarkably consistent across different markets. They are robust to using different econometric models for estimation and to different measures of volatility.

However, BFW (2013a) show that the liquidity-improving effect of AT only applies to mid-cap and large-cap stocks. For the smallest third of firms in each market, more intense AT is associated with higher trading costs. This result is important, because it illustrates that a one-size-fits-all approach to regulation could be misguided.

BFW (2013a) further document that more AT improves pricing efficiency and increases volatility, controlling for share price, trading volume, and market capitalisation. The efficiency result mirrors findings in other studies, but the volatility result is new. BFW show that the AT-induced volatility increase is not mitigated by a contemporaneous liquidity improvement. Moreover, the volatility increase reflects 'bad' volatility that is not driven by greater price efficiency.

To link AT causally to market quality, BFW (2013a) use the formal announcement of co-location events as instruments. Co-location allows fast traders to physically locate their computer hardware next to the exchange's IT hardware to minimise data turnaround times. These events are essential in facilitating AT and represent exogenous shocks to AT that do not directly affect market quality. BFW also develop instruments based on co-location events and use them to assess the effect of exogenous changes in AT. They find that AT causally affects market quality – more AT improves liquidity and efficiency, but increases volatility.

Volatility is important to traders and issuers. The result that AT increases volatility is consistent with the model designed by Martinez and Rosu (2013), who find that volatility increases when more HF traders enter the market or when their information becomes more precise. Greater volatility makes using limit orders more costly by increasing the option value to liquidity demanders, and this discourages the marginal trader from supplying liquidity. Greater volatility also increases price uncertainty for traders, which makes trading more costly to risk-averse market participants (Hasbrouck [2013]). Therefore, higher volatility can reduce future liquidity or increase the required compensation for liquidity suppliers, making liquidity more costly. Finally, issuers dislike volatility because higher volatility may lower share prices or make subsequent equity issues more difficult.

This insight suggests an analysis of potential longer-term consequences of AT. Stulz, Vagias and van Dijk (2013) show that market liquidity affects the prevalence of new equity issues. BFW (2013a) show that greater AT intensity improves short-term liquidity in mid-cap and large-cap firms. If liquidity levels are persistent, this direct effect could result in lower liquidity over extended horizons. Another channel involves changes in volatility. BFW also show that AT has a strong and systematic effect on intraday price volatility: more AT causes more volatility. Several traders, especially liquidity providers, dislike volatility because it increases the adverse selection risk associated with limit order strategies, the typical way of supplying liquidity. This can discourage liquidity suppliers and arbitrageurs. If the elevated volatility and the potentially associated reduction in liquidity persist over time they can adversely affect a firm's ability to raise new capital.

This is the question that BFW (2013b) address. They extend the analysis horizon to study longer-term effects of AT. More specifically, they examine whether and how firms' ability and willingness to raise new capital changes when AT becomes more intense. Following Hendershott, Jones and Menkveld (2010) and BFW (2013a), they infer proxies for AT from measures that are derived from the intensity of intraday message traffic. They use 11 years of intraday security-level quote and trade data for 42 markets around the world to study the consequences of variation in AT on capital issuance, measured as the change in net new equity capital or in new security issues. The first measure is based on McLean, Pontiff and Watanabe's (2009) measure of net new capital raised, which takes into account both new issues and equity repurchased by the firm. The second set of measures takes the actual proceeds from security sales, including both equity and debt securities.

BFW (2013b) find that greater AT intensity, measured as an annual average, is associated with a decline in net new equity issues during the subsequent year. They trace this effect to a reduction in new equity issues, but the main effect arises because firms' share repurchases increase significantly after increases in the AT intensity. They further show that this result is stronger for small firms. Overall, the results suggest that the nature of trading in a firm's stock influences decisions by the firm's management, largely in line with the results in Stulz et al (2013).

Recent studies have begun to examine whether AT can possibly contribute to elevated systemic risk. Chaboud et al (2009) and Huh (2011) look at the commonalities associated with AT strategies. Using data on FX trading, Chaboud et al find that the correlation of strategies is greater among computerised traders than among humans. Huh examines the 2005 NYSE hybrid market, which, arguably, attracts new algorithmic traders, and finds that liquidity commonality increases around this event. One problem in interpreting this result is that, in 2005, multiple venues that cater to algo traders existed. Even then, the US equity market was highly decentralised and almost every US traded equity security could be traded algorithmically in a number of different markets even before the hybrid market event. As such, the NYSE's transformation may not provide novel AT-related features to traders, and instead represents its catching up with technology.

In part to address these concerns, Boehmer and Shankar (2014) study firms on the National Stock Exchange of India (NSE). Their experiment differs from Huh's in that they use order-level data that more clearly identify trading intention than the NYSE trade-level data. Boehmer and Shankar's data also identify which order messages come from algorithmic traders. They find that more intense AT reduces commonality in order flow, returns, liquidity, and volatility, and therefore reduce the market's susceptibility to systemic shocks. These declines are more pronounced for algorithmic flow and for large-cap stocks.

Conclusions

Empirical studies of AT are still relatively scarce, but they largely seem to agree that AT has certain positive effects on market quality. The least contested result is that more AT improves the informational efficiency of prices. This finding indicates that arbitrage strategies account for a large portion of AT, and that these strategies move prices towards their fundamental values. Authors disagree on the effects that AT has on liquidity. Many studies find that more intense AT improves liquidity, but this result is not confirmed by all studies and it does not appear to apply to small-cap stocks. Indeed, small-cap stocks seem to suffer a decline in liquidity when AT becomes more intense.

AT's effect on volatility is quite robust in an international context – the most automated strategies lead to more volatility across the globe. This elevated level of volatility could lead to less liquidity for firms seeking access to equity capital or to elevated levels of systemic risk. There is indeed evidence that more AT in a year predicts a decline in net new equity in the subsequent year. Yet early evidence on the connection between AT and commonality in variables related to market quality finds that more AT makes markets less susceptible to systemic shocks.

Overall, AT has direct effects on market ►

◂ quality as captured by measures of liquidity, price efficiency, and volatility. While some of these effects are desirable (increased liquidity for larger stocks and better price discovery), others are not (less liquidity in small caps and higher volatility for all stocks). AT also affects broader economic measures. Again, some of these are desirable (lower co-movement of market variables), while others are not (new equity capital is more difficult to access). This broad range of AT-related effects and the underlying cross-sectional differences in these effects call for a measured, well thought-out approach to regulation that considers all parties who have an interest in well-functioning equity markets.

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Global equity factor investing using country indices

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There is now considerable evidence supporting the view that there are sources of return beyond traditional asset classes. Size, value and momentum risk premia are regarded as separate, independent sources of excess returns from the equity market premium. The existence of multiple risk premia means that the capitalisation-weighted portfolio of all stocks (the market portfolio) is no longer efficient. If factor returns are independent across countries, investing in a global portfolio of 'style' funds should provide considerable efficiency gains to a global equity portfolio. In this article we focus on two issues pertaining to factor investing and in particular (a) the role of country indices[1] in building a globally-diversified portfolio of market, value, size and momentum premia and (b) whether a dynamic portfolio strategy based on predictions of future risk could be used to avoid periods of low returns and high volatility in factor premia.

The existence of value, size and momentum premia based on country indices is intriguing for two reasons. First, it raises the question of whether country-based factor premia can be used to build a global portfolio of multiple premia that enhance the performance of the world market portfolio. Second, it raises the additional question of whether country-based risk premia are similar to the risk premia documented using individual stocks. If country-based are similar to stock-based risk premia it is easier and less expensive to implement portfolio-based passive investment strategies using futures or ETFs than constructing stock-based factor portfolios.

Our evidence suggests that country-based value, small cap and momentum portfolios outperform the world market portfolio by 4.43%, 1.46% and 3.39% per annum respectively. We also find that country-based factors are good proxies for stock-based factor portfolios with similar average returns but higher volatilities. The advantage of country compared to individual stock-based factor portfolios is a significant reduction in the management and transaction costs achieved when liquid futures and/or country ETFs are used for portfolio construction. Augmenting the world market portfolio with a global factor portfolio generates a positive alpha and improves the Sharpe ratio of the world market portfolio. Incorporating regimes in the portfolio construction process improves the performance of the global portfolio further. The results are robust to various portfolio construction methodologies (mean-variance optimisation, equal weights) used to create the global non-market factor portfolio.

1 The evidence reported in Richards (1997), Asness, Liew and Stevens (1997), Moskowitz and Grinblatt (1999), Bhojral and Swaminathan (2006), Balvers and Wu (2006), Blitz and van Vliet (2008), Desrosiers, L'Her and Plante (2004) and Asness, Moskowitz and Pedersen (2013) suggests that country PE ratios, market capitalisation and country past returns explain the cross-sectional differences of country or global sector returns. Asness, Moskowitz and Pedersen (2013) report consistent value and momentum premia across different markets and asset classes.

Global size, value and momentum factor portfolios using equity country indices

To construct the global factor portfolios we use the 23 developed countries making up the MSCI World index. We have chosen this particular dataset because most of the developed markets indices have well-established European-domiciled country ETFs. To construct the global factor portfolios we rank all countries at the end of June in year t by a composite valuation indicator that combines a country's price to earnings ratio (PE), price to book ratio (PB), price to cash flow ratio (PC) and dividend yield for the value portfolio, and country market capitalisation for the size portfolio. We form three portfolios containing one third of the 23 countries containing the highest, medium and lowest countries each and calculate capitalisation-weighted portfolio monthly returns over the next six months (countries remain in these portfolios from July of year t to December of the same year). We calculate the country-based momentum portfolios by ranking monthly all countries according to their six-month past performance. We form three portfolios containing in equal numbers the highest, medium and lowest momentum countries and calculate the portfolios' capitalisation-weighted monthly returns over the next month.

During the July 1981–December 2012 period the world market portfolio achieved an annualised return of 10.60% and a statistically significant excess return (market premium) of 6.04%. The annualised volatility of the market portfolio was 15.43% and the return-to-risk ratio as measured by the annualised Sharpe ratio was 0.39. The value and momentum premia were positive and statistically significantly different from zero during the period. The size premium was the smallest among the factor premia and statistically not different from zero. A country-based value tilt would have outperformed the world market portfolio by 4.43% and would have achieved an information ratio of 0.45. A momentum-biased portfolio had an alpha of 3.39% and an information ratio of 0.34. The Sharpe ratios of value and momentum portfolios (0.53 and 0.52 respectively) represent a significant improvement in the Sharpe ratio of the world market portfolio (0.39). The smallest capitalisation countries also outperformed the world market portfolio but by a much smaller margin (1.46%) compared to the other two strategies. All factor portfolios had significant tracking error against the world market portfolio.

How do country-based factor-portfolio strategies compare with stock-based portfolio strategies? The performance of country-based small-capitalisation portfolios is very similar to that of stock-based small-size portfolios (panel B, figure 1). Stock-based value outperformed their country-based counterparts (by 1.43%) but with less risk (volatility) than country-based portfolios[2]. In contrast, country-based momentum portfolios achieved a higher return than the stock-based momentum portfolios. All country-based factor portfolios had higher volatility and tracking errors than their stock-based counterparts and as a result smaller Sharpe and information ratios.

The correlation matrix of factor premia portfolios presented in panel C of figure 1 supports two conclusions. First, the correlations between the market and factor portfolios are positive but less than perfect. The less-than-perfect correlations suggest that there are diversification benefits from combining the country factors in a global factor portfolio. Second, country and stock-based estimates of the factor premia are highly correlated, supporting the view that country-based factor portfolios are good proxies for stock-based factor portfolios.

2 The hypothesis that average stock-based factor portfolio returns are different from country-based factor portfolio returns can be rejected at the 95% level of statistical significance.

1. Factor portfolios based on countries and stocks: return, risk and correlations

		Panel A: Country-based			Panel B: Stock-based		
	Market	Value	Small	Hmom	Value	Small	Hmom
Average return	10.60%	15.03%	12.06%	13.99%	16.68%	12.23%	13.35%
Standard deviation	15.43%	19.62%	19.83%	18.29%	15.88%	15.26%	15.03%
Excess return	6.04%	10.47%	7.50%	9.43%	12.12%	7.68%	8.79%
Sharpe ratio	0.39	0.53	0.38	0.52	0.76	0.50	0.58
Raw alpha		4.43%	1.46%	3.39%	6.08%	1.63%	2.75%
t-statistic alpha ≠ 0		2.95	0.63	1.88	3.88	0.82	2.40
Tracking error		9.81%	11.45%	9.88%	6.70%	10.08%	6.12%
Information ratio		0.45	0.13	0.34	0.91	0.16	0.45

Panel C: Correlation analysis		Country-based			Stock-based		
	Market	Value	Small	Hmom	Value	Small	Hmom
Market	1.00						
Country-based value	0.87	1.00					
Country-based small	0.82	0.87	1.00				
Country-based Hmom	0.84	0.77	0.74	1.00			
Stock-based value	0.91	0.81	0.78	0.74	1.00		
Stock-based small	0.78	0.70	0.74	0.65	0.84	1.00	
Stock-based Hmom	0.92	0.76	0.74	0.81	0.80	0.78	1.00

The table shows the annualised average, excess return, standard deviation, Sharpe ratios, the return of the portfolios in excess of the world market portfolio (raw alpha), tracking errors and information ratios of the country-based (panel A) and stock-based (panel B) factor portfolios. The stock-based portfolios use data from the G7 markets: Canada, France, Germany, Italy, UK and US. The global size, value and momentum portfolios are calculated as a value-weighted average of individual country portfolios. T-statistics are based on HAC standard errors. Panel C presents the correlation coefficients between market, country-based and stock-based portfolios. The sample period is from July 1981–December 2012.

2. Combining the world market portfolio with global factors

		Average return	Standard deviation	Sharpe ratio	Raw alpha	Tracking error	Information ratio
World market portfolio		10.60%	15.43%	0.39			
World market + global factor portfolio							
– MV	TE 2%	11.63%	15.75%	0.45	1.02%	1.96%	0.52
	TE 5%	13.16%	16.66%	0.52	2.55%	4.89%	0.52
– EW	TE 2%	11.41%	15.76%	0.43	0.81%	1.98%	0.41
	TE 5%	12.63%	16.69%	0.48	2.03%	4.94%	0.41

The table shows the performance statistics of combinations of the world market portfolio with the global factor portfolio. Global factor portfolios are created using mean-variance (MV) optimisation and equal weights (EW). The combined world market and global factor optimal portfolio is created under the assumption of tracking error constraints of 2% (low active risk) and 5% (high active risk) against the world market portfolio. The sample period is from July 1981–December 2012.

"The positive value, size and momentum premia and the less-than-perfect correlation between them and the world market portfolio suggest that augmenting the world market portfolio with a global factor portfolio will improve the return-to-risk trade-off offered by the market portfolio"

A globally diversified factor portfolio

The positive value, size and momentum premia and the less-than-perfect correlation between them and the world market portfolio suggest that augmenting the world market portfolio with a global factor portfolio will improve the return-to-risk trade-off offered by the market portfolio. To construct the global factor portfolio we use mean-variance optimisation but, recognising that in practical implementation estimation errors could lead to extreme portfolios, we also create the global factor portfolio by equally weighting the three factor portfolios. For the combination of the global factor portfolio with the world market portfolio we use mean-variance optimisation to create optimal portfolios under the assumption of tracking error constraints of 2% (low active risk) and 5% (high active risk) against the world market portfolio (figure 2).

Tilting the world market portfolio to the value, small cap and momentum factors while at the same time targeting a tracking error of 2% per annum, achieves a return of 11.63%, a standard deviation of 15.75% and a Sharpe ratio of 0.45. The combined portfolio outperforms the world market portfolio by 1.02% per annum and has an information ratio of 0.52. Relaxing the tracking error constraint (to 5%) increases the alpha of the combined portfolio to 2.55% and its Sharpe ratio to 0.52. Using equal weights to construct the global factor portfolio produces similar performance in terms of return and risk to portfolios generated from mean-variance optimisation. Augmenting the world market portfolio with a global factor portfolio (mean-variance or equally weighted) improves both the total and active return to risk trade-off offered by the world market portfolio.

Regime-dependent factor allocation

Current research suggests that the distribution of asset returns is time-varying, characterised by periods of turbulence with high volatility and low returns followed by calmer periods with low volatility and above-average returns. ►

◄ In the presence of regimes, portfolio managers should hold different portfolios depending on their forecasts of the future risk state. Regime-based portfolio management is an attractive alternative to the traditional 'one portfolio fits all' investment management practice.

Our empirical evidence presented in figure 3 suggests that during the high volatility regime (145 months, 38% of the sample) the return-to-risk trade-off for all factor portfolios is close to zero. The excess returns of all portfolios are lower in the high-risk regime than in the low-risk regime. In fact the market portfolio excess return is close to zero for the market, value portfolios and negative for the small-capitalisation portfolio. Portfolio volatility is markedly higher in the high-risk regime for all portfolios. In contrast, average excess returns are statistically different from zero in the low-risk regime. If regimes can be predicted the investor would hold a less risky portfolio (cash if available) in the high-risk regime and a riskier portfolio when risk is low.

At the end of each year, starting in December 1999, we construct a high-risk and low-risk global portfolio based on historical returns up to the end of the year. We create dynamic forecasts of month t state probabilities using the regime model estimated using data until period t–1. Depending on the next state's prediction we assume that the investor holds either a low or a high-risk portfolio. To control turnover we keep the composition of these portfolios the same over the next year. The dynamic generation of state forecasts and low/ high risk portfolios using each time data available at the time of forecasting and portfolio construction produces the out-of-sample monthly portfolio returns (figure 4).

During the out-of-sample period, the world market portfolio achieved an annual arithmetic average return of 3.26%, compared to an average return of 10.60% for the full sample. The value, size and momentum portfolios also had significantly lower excess returns than the full sample (3.48% versus 10.51% for value, 3.73% versus 7.54% for size and 0.61% versus 9.47% for momentum, for the 2000–12 and July 1981–December 2012 samples respectively). Volatilities were also higher in the out-of-sample period, which includes the credit crisis, and when combined with lower returns produced sharply low Sharpe ratios in the out-of-sample period. For example, the Sharpe ratio for the world market portfolio decreases from 0.39 to 0.07, of the value portfolio from 0.53 to 0.14, of the small-cap portfolio from 0.38 to 0.16 and of the momentum portfolio from 0.52 to 0.04. In the out-of-sample period, equity investors received smaller compensation for bearing risk.

Under a regime-dependent portfolio construction methodology, the investor holds different portfolios depending on her forecasts of the future risk regime. In this low return environment, the dynamic portfolio strategy that combines the world market portfolio with a global portfolio of factors in a risk-on risk-off framework achieved a return of 4.35% and outperformed the world market portfolio by 1.09% for the low active risk portfolio and by 1.99% for the high active risk portfolio. The dynamic global factor portfolio increases the Sharpe ratio of the world market portfolio from 0.07 to 0.12 (0.15) for the low (high) active risk portfolio. An equally-weighted portfolio of the factors dynamically combined with the world market portfolio improves performance further. The Sharpe ratio increases to 0.14 (tracking error 4.14%) and 0.17 (tracking error 6.36%). The breakeven transaction costs[3] estimates suggest that unless the investor faces impossibly high transactions costs, the regime-based portfolio strategy will be profitable net of transaction costs for most investors. Even retail investors today have access to the low-cost country ETFs needed to create the factor portfolios and implement the tactical moves suggested by the regimes.

Factor portfolios created by dynamically weighting country indices generated significant global market-adjusted returns over the last 30 years. The comparison between stock and country-based factor portfolios suggests that country-based value, size and momentum factor portfolios implemented through index futures or country ETFs capture a large part of the return of stock-based factor strategies. Given the complex issues and costs involved in implementing stock-based factor strategies in practice, country-based factor strategies offer a viable alternative. The behaviour of the market and factor portfolios is dependent on the risk regime. A regime-dependent dynamic global factor portfolio outperforms the world equity market portfolio.

3. Global factors performance in high/low risk regimes

		Excess return (Er)	Volatility	t-stat Er ≠ 0	Sharpe ratio
High risk	Market	0.14%	19.84%	0.02	0.01
	Value	1.24%	23.39%	0.18	0.05
	Small cap	–4.78%	24.12%	–0.69	–0.20
	Momentum	4.00%	21.98%	0.63	0.18
Low risk	Market	9.72%	11.84%	3.61	0.75
	Value	15.97%	15.29%	4.60	0.99
	Small cap	17.81%	15.07%	5.21	1.12
	Momentum	13.24%	15.16%	3.85	0.81

Number of months in high-risk regime: 145. Number of months in low-risk regime: 233.

The table shows the excess return, standard deviation, t-statistic testing the hypothesis that the excess return is zero and the Sharpe ratio of the world market portfolio and the global value, size and momentum portfolios in the high and low volatility regimes identified by the regime model. The sample period is from July 1981–December 2012.

4. State-dependent global factor portfolios: out of sample

		Average return	Standard deviation	Sharpe ratio	Raw alpha	Tracking error	Information ratio	Turnover	Breakeven tr costs
World market portfolio		3.26%	16.64%	0.07					
World market + global factor portfolio									
– MV	TE 2%	4.35%	18.35%	0.12	1.09%	3.93%	0.28	41.80%	2.60%
	TE 5%	5.25%	20.77%	0.15	1.99%	8.06%	0.25	106.99%	1.86%
– EW	TE 2%	4.63%	18.60%	0.14	1.37%	4.14%	0.33	46.69%	2.94%
	TE 5%	5.58%	19.90%	0.17	2.32%	6.36%	0.37	56.25%	4.13%

This table shows out-of-sample performance statistics for portfolios constructed dependent on the risk regime. It shows the performance statistics of combinations of the world market portfolio with the global factor portfolio. Global factor portfolios are created using mean-variance (MV) optimisation and equal weights (EW). Regime-optimal portfolios are created under the assumption of tracking error constraints of 2% (low active risk) and 5% (high active risk) against the single-state optimal portfolio.

At the end of each year, starting in December 1999, we construct a high-risk and low-risk portfolio based on historical returns up to the end of the year. We create dynamic forecasts of month t state probabilities using the regime model estimated using data until period t–1. Depending on the next state's prediction we assume that the investor holds either a low or high-risk portfolio. To control turnover we keep the composition of these portfolios the same over the next year. The dynamic generation of state forecasts and low/high risk portfolios using each time data available at the time of forecasting and portfolio construction produces the out-of-sample monthly portfolio returns. The sample period is from January 2000–December 2012.

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3 Breakeven transactions costs are defined as the fixed transaction cost that makes the excess return of global factor portfolios against their benchmarks equal to zero. High estimates suggest that the dynamic portfolio strategy is likely to be profitable net of transaction costs for most investors.

Performance of idiosyncratic volatility strategies in commodity markets: delusion or reality?

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The link between idiosyncratic volatility and returns has received scant attention in commodity futures markets although the corresponding literature for equities is very prolific. This article attempts to fill the gap by utilising various pricing models as benchmarks to extract the idiosyncratic volatility signal. We find that the abnormal performance of active strategies that systematically exploit idiosyncratic volatility is an illusion created by the choice of an inappropriate benchmark that fails to account for backwardation and contango.

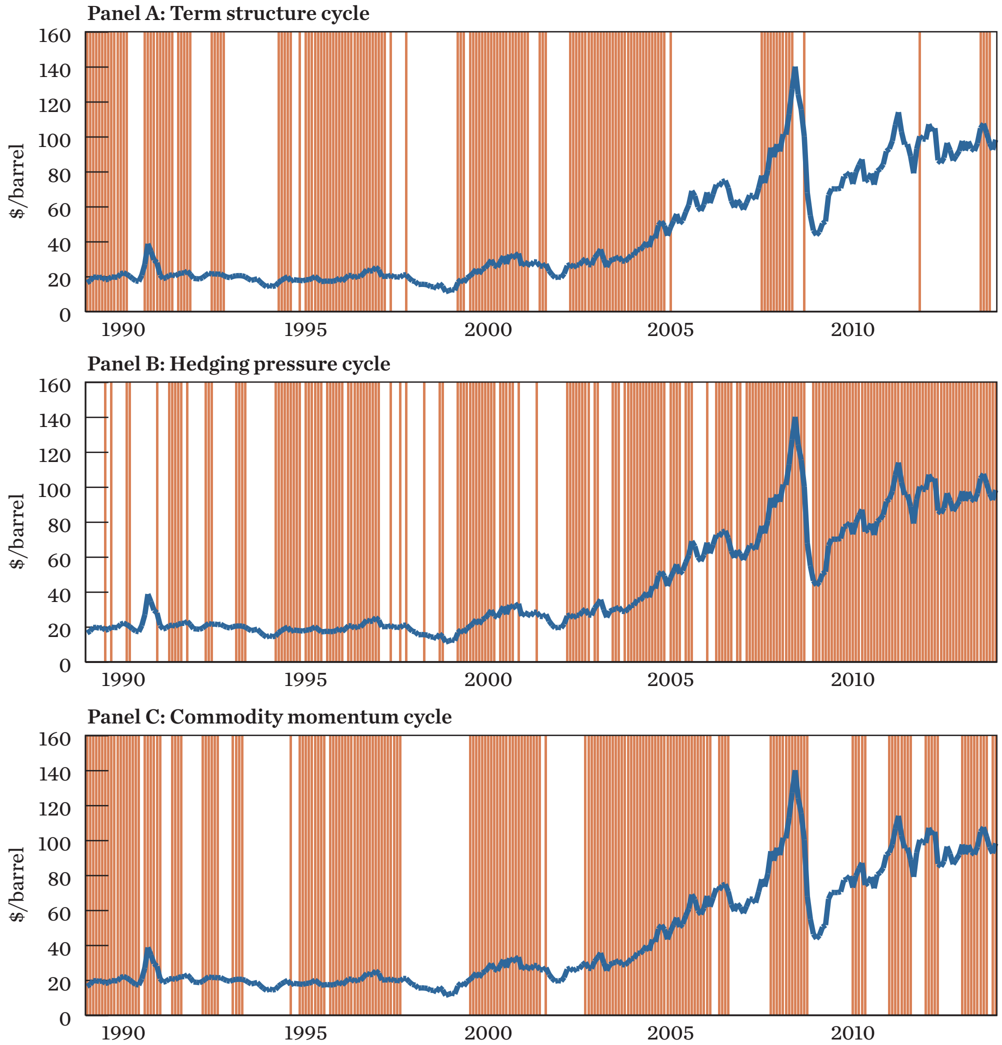
Defining the risk premium of commodity futures contracts

Idiosyncratic volatility of an asset is conventionally defined as the standard deviation of the estimated errors from a regression that describes the relationship between systematic risk and expected return. But which risk factors are plausible candidates in the context of commodities? We measure idiosyncratic volatility relative to two types of pricing models as benchmarks. Inspired by the traditional asset pricing literature, the first set of risk factors includes the S&P-GSCI, the US value-weighted equity index, the equity size (known as SMB) factor, equity value (HML) factor, equity momentum factor and Barclays bond index. The data are obtained either from Kenneth French's web library or from Bloomberg.

Motivated by the theory of storage (Kaldor [1939]; Fama and French [1987]) and the hedging pressure hypothesis (Cootner [1960]), the second set of risk factors is designed to capture commodity fundamentals relating to backwardation and contango. Backwardation means that futures prices are expected to rise as maturity approaches. It is signalled by downward-sloping term structures (positive roll-yields), net short hedgers, net long speculators and good past performance (backwardated commodities are momentum winners).[1] The concept is illustrated in figure 1, which plots the evolution in front-end crude oil futures prices. Shaded areas signify months with downward-sloping futures curves in panel A, months with net long speculators in panel B and months with positive 12-month past average returns in panel C. The three panels visually confirm that futures prices tend to rise in backwardated markets.

Our next task is to construct long-short commodity risk factors that capture the fundamentals of backwardation and contango. Using a cross-section of 27 commodity futures[2], the term structure portfolio buys the 20% of contracts with the most downward-sloping term structures and shorts the 20% of contracts with the most upward-sloping term structures. The hedging pressure portfolio buys the 20% of contracts for which hedgers are the shortest and speculators the longest and sells the 20% of contracts for which hedgers are the longest and speculators the shortest. Finally, the momentum portfolio buys the 20% of contracts with the best past performance and sells the 20% of contracts with the worst past performance.

1. Historical crude oil futures prices



The figure plots monthly futures prices of crude oil alongside shaded areas which indicate backwardated months when the monthly average of daily roll-yields is positive (panel A), when speculators are net long at the beginning and end of month (panel B) and when 12-month past returns are positive (panel C).

1 Vice versa, contango means that futures prices are expected to drop. It is hinted by upward-sloping term structures (or negative roll-yields), net long hedgers, net short speculators, and poor past performance (losers).

2 We use 12 agricultural commodities (cocoa, coffee C, corn, cotton no 2, frozen concentrated orange juice, oats, rough rice, soybean meal, soybean oil, soybeans, sugar no 11, wheat), five energy commodities (electricity, gasoline, heating oil no 2, light sweet crude oil, natural gas), four livestock commodities (feeder cattle, frozen pork bellies, lean hogs, live cattle), five metal commodities (copper, gold, palladium, platinum, silver), and random length lumber. The futures returns are constructed by holding the nearest-to-maturity contract up to one month before maturity and then rolling to the second nearest contract which lessens illiquidity.

The ranking period over which the three signals are averaged is 12 months, and the holding period is one month. The constituents of the long-short portfolios are equally weighted with end-of-month rebalancing and the portfolios are fully collateralised. The dataset spans the period from January 1989 to December 2013; the frequency of the data is daily.

Figure 2 summarises the performance of the various risk factors. Panel A focuses on the factors originating from the traditional asset pricing literature and panel B on the long-short commodity risk factors. The Sharpe ratios of the long-short commodity portfolios range from 0.41 to 0.51 with an average at 0.46, whereas that of the S&P-GSCI merely stands at 0.02. This reinforces the well-documented fact that investors benefit from taking long positions in backwardated markets and short positions in contangoed markets.

2. Summary statistics for risk factors

	Mean		Standard deviation	Sharpe ratio
Panel A: Traditional risk factors				
S&P-GSCI	0.0042	(0.10)	0.2122	0.0198
Equity market	0.0754	(2.07)	0.1783	0.4228
Barclays bond index	0.0373	(4.69)	0.0389	0.9597
Size (SMB)	0.0110	(0.60)	0.0894	0.1229
Value (HML)	0.0283	(1.52)	0.0908	0.3117
Equity momentum	0.0836	(3.02)	0.1353	0.6179
Panel B: Long-short commodity risk factors				
Term structure	0.0418	(2.02)	0.1009	0.4140
Hedging pressure	0.0448	(2.29)	0.0955	0.4694
Commodity momentum	0.0601	(2.48)	0.1186	0.5069

The table presents in panel A summary statistics for long-only traditional risk factors. Panel B presents summary statistics for long-short commodity risk factors based on term structure, hedging pressure and momentum signals. The observations are daily returns from 3 January 1989–31 December 2013. Conventional significance t-ratios are reported in parentheses. Sharpe ratios are annualised mean excess returns (Mean) divided by annualised standard deviations.

Performance of idiosyncratic volatility strategies

Our methodology follows closely Ang et al (2009) in their analysis of the relation between idiosyncratic volatility (*IVol* hereafter) and future equity returns. At the time of portfolio formation, we measure the idiosyncratic volatility of each commodity as the standard deviation of the estimated errors (or residuals) from the following empirical pricing model

$$r_{i,d} = \alpha_i + \beta_i f_d + \varepsilon_{i,d} \qquad d = 1, \ldots, D$$

where D is the number of days in the time window (ranking period R) spanning one, three, six or 12 months, $r_{i,d}$ is the day d return of the i^{th} commodity futures, f_d is a vector of factor returns associated with the chosen benchmark on day d, $\varepsilon_{i,d}$ is an innovation and $\{\alpha_i,\beta_i\}$ are OLS parameters. For a given benchmark, the *IVol* strategy buys the quintile of commodities with the lowest *IVol* over the past R (= 1, 3, 6 or 12) months, sells the quintile with the highest *IVol* and holds the long-short portfolio for a month. For consistency with the construction of the long-short commodity risk factors, the long-short *IVol* portfolios are fully collateralised, rebalanced at the end of each month and based on equal weights for the constituents of the top and bottom quintiles. Figure 3 summarises the performance of *IVol* strategies designed upon traditional benchmarks (panel A) and benchmarks based on long-short commodity risk factors (panel B). Panel C reports summary statistics for an equally-weighted portfolio of the 16 *IVol* portfolios of panel A and the 16 *IVol* portfolios of panel B.

An equally-weighted portfolio of the 16 *IVol* strategies built upon the traditional benchmarks earns 3.93% a year, significant at the 5% level; 14 of these 16 strategies generate significantly positive mean excess returns at the 10% level or better (panel A). In sharp contrast, an equally-weighted portfolio of the 16 *IVol* strategies built upon benchmarks with long-short commodity risk factors earns an economically and statistically insignificant 1.22% a year; none of these 16 strategies generate significantly positive mean excess returns at the 10% level (Panel B). Likewise, the Sharpe ratios are more optimistic for *IVol* strategies based on traditional risk factors (averaging 0.37 in Panel A) than for *IVol* strategies based on long-short commodity risk factors (averaging 0.12 in Panel B). The t-test for the difference in Sharpe ratios developed by Opdyke (2007) confirms, with a statistic equal of 1.74 in the present context, the contrast between the two types of *IVol* strategies.

The alpha or abnormal return captured ►

3. Summary performance of idiosyncratic volatility mimicking portfolios

	Mean		Standard deviation	Sharpe ratio	Alpha		Mean		Standard deviation	Sharpe ratio	Alpha	
	Panel A: Traditional risk factors						Panel B: Fundamental (long-short commodity) risk factors					
	S&P-GSCI						Term structure					
R = 1	0.0432	(1.99)	0.1062	0.4069	0.0429	(2.01)	0.0258	(1.13)	0.1108	0.2325	0.0259	(1.12)
R = 3	0.0388	(1.80)	0.1053	0.3684	0.0385	(1.78)	0.0093	(0.42)	0.1095	0.0851	0.0087	(0.38)
R = 6	0.0365	(1.68)	0.1057	0.3453	0.0361	(1.67)	0.0054	(0.24)	0.1073	0.0499	0.0051	(0.23)
R = 12	0.0440	(2.02)	0.1064	0.4133	0.0435	(2.05)	0.0048	(0.22)	0.1065	0.0447	0.0052	(0.24)
Average	0.0406		0.1059	0.3835	0.0402		0.0113		0.1085	0.1031	0.0112	
	S&P-GSCI, equity and bond indices						Hedging pressure					
R = 1	0.0404	(1.87)	0.1057	0.3823	0.0372	(1.76)	0.0270	(1.22)	0.1078	0.2503	0.0202	(0.92)
R = 3	0.0369	(1.70)	0.1057	0.3495	0.0344	(1.58)	0.0089	(0.39)	0.1119	0.0798	0.0006	(0.03)
R = 6	0.0420	(1.92)	0.1059	0.3965	0.0413	(1.90)	0.0182	(0.80)	0.1106	0.1642	0.0104	(0.46)
R = 12	0.0398	(1.78)	0.1069	0.3722	0.0395	(1.81)	0.0075	(0.33)	0.1109	0.0679	-0.0007	(-0.03)
Average	0.0398		0.1060	0.3751	0.0381		0.0154		0.1103	0.1405	0.0076	
	S&P-GSCI, equity and bond indices, SMB and HML						Commodity momentum					
R = 1	0.0425	(1.96)	0.1057	0.4021	0.0402	(1.86)	0.0131	(0.62)	0.1028	0.1271	0.0159	(0.76)
R = 3	0.0404	(1.87)	0.1054	0.3838	0.0389	(1.79)	0.0038	(0.17)	0.1060	0.0356	0.0065	(0.29)
R = 6	0.0405	(1.84)	0.1064	0.3803	0.0405	(1.84)	0.0012	(0.06)	0.1040	0.0115	0.0051	(0.23)
R = 12	0.0399	(1.79)	0.1071	0.3731	0.0403	(1.84)	-0.0013	(-0.06)	0.1014	-0.0130	0.0007	(0.03)
Average	0.0408		0.1062	0.3848	0.0400		0.0042		0.1036	0.0403	0.0070	
	S&P-GSCI, equity and bond indices, SMB and HML, equity momentum						Term structure, hedging pressure and commodity momentum					
R = 1	0.0278	(1.29)	0.1053	0.2640	0.0258	(1.21)	0.0226	(1.13)	0.0977	0.2309	0.0196	(0.98)
R = 3	0.0358	(1.64)	0.1062	0.3372	0.0358	(1.64)	0.0202	(0.99)	0.0991	0.2036	0.0165	(0.80)
R = 6	0.0400	(1.82)	0.1066	0.3754	0.0412	(1.86)	0.0172	(0.84)	0.0998	0.1719	0.0139	(0.65)
R = 12	0.0395	(1.77)	0.1071	0.3689	0.0417	(1.90)	0.0117	(0.56)	0.1017	0.1150	0.0063	(0.30)
Average	0.0358		0.1063	0.3364	0.0362		0.0179		0.0996	0.1803	0.0141	
	Panel C: Comparison of average performance across benchmarks											
	0.0393	(2.00)	0.1061	0.3699	0.0386		0.0122	(0.64)	0.1055	0.1161	0.0100	
							(1.13)			(1.74)	(12.80)	

The table reports annualised mean excess return (Mean), standard deviation, Sharpe ratio and alpha of long-short idiosyncratic volatility portfolios. R stands for the ranking period used to measure idiosyncratic volatility. The holding period is one month throughout. t-statistics are shown in parentheses. Idiosyncratic volatility is defined, and performance is gauged, according to traditional risk factors in Panel A and long-short commodity risk factors in Panel B. In the last row of Panel C we report in parentheses the ordinary t-test for differences in mean return, the Opdyke (2007) t-test statistic for the significance of differences in the Sharpe ratio and the ordinary t-test for differences in alpha performance of the equally-weighted idiosyncratic volatility portfolios reported in Panel A versus Panel B.

by the intercept parameter (in a regression of daily *IVol* returns on the systematic risk factors) also suggests that *IVol* strategies based on traditional risk factors are over-optimistic relative to those based on long-short commodity risk factors. The former strategies (reported in panel A of figure 3) deliver an alpha of 3.86% a year on average while the alpha of the latter strategies is much smaller at 1% (panel B); the difference is statistically significant at the 1% level (t-statistic of 12.80 in panel C). The Newey and West (1987) t-test confirms that the alpha of *IVol* strategies designed upon traditional benchmarks is positive and generally significant at the 10% level or better whereas the alpha of *IVol* strategies based on long-short commodity risk factors is insignificant.

Conclusions

This article investigates the relation between idiosyncratic volatility and expected returns in commodity futures markets. The main finding is that the significantly abnormal performance of *IVol* portfolios in commodity futures markets is an 'illusion' of the asset pricing model employed as benchmark to extract the *IVol* signal. We show that when traditional benchmarks are used the commodity futures *IVol* portfolios appear to perform remarkably well as suggested by an annualised mean excess return, Sharpe ratio and alpha of 3.93%, 0.37 and 3.86% on average, respectively. When the benchmarks are based on long-short commodity risk factors that exploit term structure, hedging pressure or momentum signals (and thus capture the fundamentals of backwardation and contango) the mean excess return, Sharpe ratio and alpha shrink to 1.22%, 0.12 and 1% a year on average, respectively.

The seemingly abnormal profits made by selling commodities with high idiosyncratic volatility and buying commodities with low idiosyncratic volatility is an artifact of two methodological issues pertaining to the choice of asset pricing model. One is that the idiosyncratic volatility signal derived from traditional benchmarks is not idiosyncratic because it contains a systematic risk component related to the backwardation and contango fundamentals. Another is that the alpha is gauged using an improper benchmark.

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Improving traditional risk parity strategies by considering more appropriate risk measures than historical volatility

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Since 2008, risk parity has become a popular approach to building well-diversified portfolios that does not rely on any assumption of expected returns, thus placing risk management at the heart of the portfolio construction process. This explains why an increasing number of pension funds and other institutional investors are now using this approach both within asset classes, and notably for the development of smart beta equity and bond benchmarks[1], and across asset classes – ie, for the redefinition of their long-term investment policy portfolios[2].

In a nutshell, the goal of this methodology is to ensure that the risk contributions will be identical for all constituent assets of the portfolio. This heuristic approach stands in contrast with the more traditional approach to naive diversification, the equally-weighted portfolio, which is by construction well balanced in terms of dollar contributions, but concentrated in terms of risk contributions. This risk budgeting approach method is also different from scientific approaches to portfolio diversification, including mean-variance optimisation and its variants, such as the Black-Litterman model, which incorporates parameter uncertainty. One key advantage of risk budgeting is that it is much less sensitive to errors in input parameters and does not produce corner solutions that are typical outcomes of portfolio optimisation programmes.

These desirable properties and the attractive performance of such strategies in recent years undoubtedly explain the success of risk parity diversified funds based on equities, bonds and commodities. For instance, Invesco manages about $22bn (€16.6bn) using a risk parity strategy[3]. Another commercial success is Bridgewater's All Weather Fund, which is one of the largest hedge funds in the world.

However, risk parity strategies also suffer from a number of shortcomings:

- Standard approaches to risk parity are based on portfolio volatility as the risk measure, implying that upside risk is penalised as much as downside risk, in obvious contradiction with investors' preferences.
- Typical risk parity strategies inevitably involve a substantial overweighting of bonds with respect to equities, which might be a problem in a low bond yield environment, with mean reversion implying that a drop in long-term bond prices might be more likely than a further increase in bond prices. More generally, risk parity strategies do not take into account changing economic environments and in particular time-varying risk premia.

Perhaps as a consequence of these shortcomings, the performance of risk parity funds was disappointing overall in 2013. Indeed, most of them posted negative or flat performances in a context of strong equity returns. Moreover, dispersion among their performances was high, with as much as a 20% difference between the best and worst performers.

1 Asset managers and index providers have launched several risk parity products and indices on equities, for example FTSE, LODH, Lyxor, FTSE, ERI Scientific Beta, and also on bonds, for example, Aquila Capital and Lyxor.

2 See, for instance, the special report on risk parity published by IPE in June 2012 and the interview with Henrik Gade Jepsen, CIO of Danish pension fund ATP.

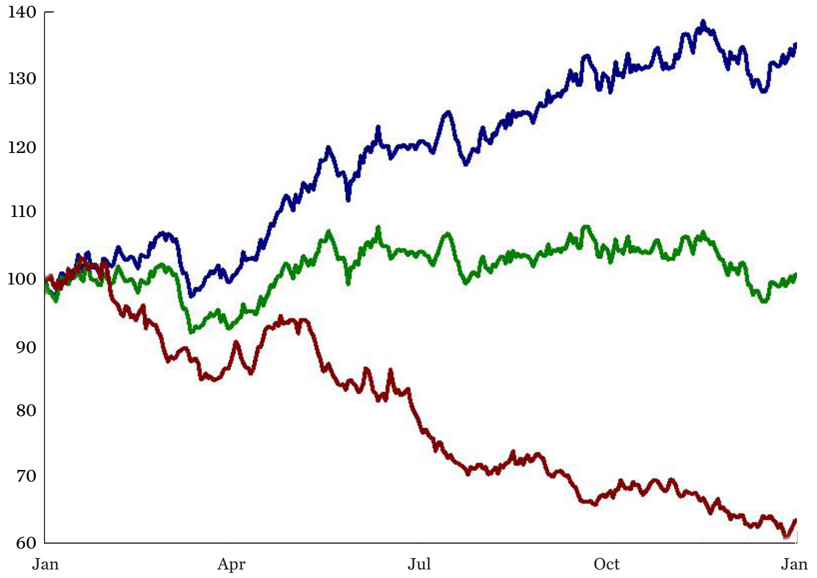
3 Source: Invesco Balanced-Risk Allocation Fund Fourth Quarter 2013.

What the original risk parity strategy is – and what it is not

In the original articles by Qian (2005) and Maillard et al (2010), the authors use volatility as the risk measure to define the risk parity portfolio. For instance, if equity volatility is four times greater than bond volatility, the risk parity portfolio leads to the 20/80 asset mix policy[4]. This portfolio may be compared to the 50/50 or 60/40 stock/bond asset mix policies, which represent traditional balanced diversified portfolios used by the asset management industry and retirement systems (Benartzi and Thaler [2001]). Such standard portfolio policies actually imply a massive domination of stocks in portfolio risk, whatever the risk measure considered (Roncalli [2013]), and as such do not represent well-diversified portfolios[5].

One key misconception, however, is that investors often consider risk parity strategies as absolute return strategies, a view that is largely due to the fact that a number of hedge funds have launched their own risk parity funds, like AQR Capital Management[6] and Bridgewater Associates[7]. As a matter of fact, the original risk parity strategy is not an absolute return strategy; it is instead a directional attempt to harvest risk premia across or within asset classes in the most efficient way.

1. Time-series performance of three asset classes with identical volatilities but different directional risks



A new generation of risk parity strategies

As explained above, a risk parity portfolio is typically defined by considering volatility as the risk measure. However, there are three main (related) issues with this approach.

The first issue is the consistency of this risk measure across asset classes and more broadly its relevance for some asset classes. It is not obvious indeed that historical volatility of market returns has the same meaning for equities, sovereign bonds, corporate bonds, inflation-linked bonds, commodities, etc. In particular, market volatility does not fully reflect the risk taken by an investor when investing in bonds, because it only partially incorporates default risk[8]. For example, the recent crisis in the euro-zone sovereign bond markets has not been accompanied by a massive increase in historical market volatility.

Another drawback of using historical volatility risk measures for bond returns is their lack of sensitivity to yield levels. To alleviate this concern, Martellini et al (2014) develop an alternative bond volatility measure, which explicitly links bond return volatility to yield levels through a first-order approximation based on the bond duration. They show that duration-based volatility is an instantaneous and observable volatility bond measure that avoids the sample dependency and overweighting of bonds in a low interest rate environment, which inevitably follow from the use of historical volatility measures in the construction of risk parity portfolios.

The third issue concerns the very nature of volatility as a risk measure. As discussed above, choosing volatility as the reference risk measure in the definition of risk parity portfolios can be criticised for not capturing investors' concerns over downside risk. It turns out that, under some technical assumptions, risk parity strategies can be extended to more general risk measures. For instance, Roncalli (2013) and Martellini et al (2014) provide analytical expressions for several downside risk measures such as semi-volatility, Gaussian value-at-risk, historical expected shortfall, Cornish-Fisher value-at-risk, etc. Martellini et al (2014) also analyse and compare different forms of risk parity portfolios based on such measures and show that risk parity portfolios constructed with a downside risk measure show a higher degree of sensitivity with respect to changes in market conditions, and lead to further decreases in bond allocation in a low yield environment compared to risk parity portfolios constructed on the basis of volatility as a risk measure.

Why directional risks matter

This new generation of risk parity strategies, which are sometimes known as conditional risk parity strategies to emphasise their higher degree of reactivity to changes in market conditions, introduces a new dimension, which is the directional risk, as reflected in particular in the first moment (expected return) and third moment (skewness) of asset return distributions, in addition to volatility and kurtosis (Roncalli [2013]; Martellini et al [2014]; Roncalli [2014]).

This new approach recognises that risk cannot only be summarised as the daily fluctuations of prices. In figure 1, we have reported the prices of three assets with the same volatility, which is equal to 20%. For the standard risk parity approach, there is no difference between the three assets because they present the same volatility patterns. For the conditional risk parity approach, the three assets may not present the same risk patterns because they do not have, for instance, the same directional risks as can be seen by the very different trends.

By reintroducing expected returns into the risk measure, it is tempting to view a risk parity portfolio as a diversified mean-variance portfolio. However, the two approaches give different solutions (Roncalli [2014]). Moreover, Martellini et al (2014) and Roncalli (2014) find that the maximum Sharpe ratio portfolio, which can be interpreted as a risk parity portfolio under some conditions (identical pairwise correlations and identical Sharpe ratios), is a less robust alternative to incorporating expected returns in the construction of a well-diversified policy portfolio. In this sense, Roncalli (2014) concludes that conditional risk parity is a robust model of active portfolio management, allowing investors and asset managers to incorporate active views about asset classes without concentrating their portfolios on a small number of bets, as is often the case for optimisation-based approaches. This explains why conditional risk parity strategies are also often called active risk parity strategies by the asset management industry.

If we consider a standard risk parity portfolio of equities and bonds[9], we notice that the allocation is the same in June 2008 and July 2013. ►

2. Contrasted economic conditions in June 2008 and July 2013

	Period	June 2008	July 2013
Equities	PE	15.4	17.3
	DY	2.9%	2.6%
	One-year moving average	–5.0%	19.0%
Bonds	Short rate (Fed fund)	2.0%	0.1%
	Long rate (10-year US)	4.0%	2.6%
	One-year moving average	16.2%	–4.7%

4 This means that equities and bonds represent 20% and 80% respectively of the allocation.

5 See Asness et al (2012) or Chaves et al (2011) for a comparison between the risk parity and the 60/40 constant mix portfolios.

6 On the AQR website (www.aqr.com), we can read that "Among the pioneers of risk parity investing, AQR has been managing risk-balanced portfolios since inception, and dedicated risk parity strategies since 2006."

7 See for instance the article, The All Weather Story: How Bridgewater Associates Created the All Weather Investment strategy, the Foundation of the 'Risk Parity' Movement, which can be found on the Bridgewater Associates website (www.bwater.com).

8 Bruder et al (2011) propose to define risk parity portfolios on bonds by considering a more appropriate volatility risk measure that takes credit risk into account.

9 For this application, we consider the MSCI World Index TR Net index and the Citigroup WGBI All Maturities index.

◄ Thus, the weight of equities is 32% whereas the weight of bonds is 68%. This implies that these two periods present the same patterns in terms of relative levels of stock and bond volatility[10]. However, these two periods differ vastly in terms of directional risks, as can be measured through valuation, trend, risk premium, etc, as illustrated in figure 2.

For instance, if expected returns are measured by the one-year trend, the weight of equities and bonds become 51% and 49% in July 2013 (19% and 81% in June 2008)[11]. This example shows how expected return estimates are another component for measuring overall risk and have a significant impact on the allocation. In this framework, potential increases in interest rates remain a threat to risk parity strategies, but portfolio managers may address this risk by introducing active views on directional changes in interest rates.

In this sense, conditional risk parity strategies are a response to some of the concerns and misunderstandings raised by the original approach risk parity. By introducing expected returns into risk parity portfolios, the strategy becomes an active management strategy. In this context, the performance of active risk parity will obviously depend on the skills of the portfolio manager to define expected returns. Nevertheless, the simplicity of the original risk parity strategy has been lost and the performance of active risk parity becomes heterogeneous, which undoubtedly explains the large differences observed in 2013.

Conclusion

Risk parity is a generic term used by the asset management industry to designate portfolio construction methodologies based on risk budgeting. However, it covers different approaches. Whereas the standard approach to risk parity (referring to the equal risk contribution portfolio based on the volatility risk measure) is used to design a well-diversified strategy, a new generation of risk parity strategies is emerging that considers more sophisticated risk measures and incorporates expected return inputs. These novel approaches are better adapted to react to changes in interest rate and/or risk premium levels. In this framework, risk parity becomes a robust active management model, which arguably comes at the cost of losing some of the simplicity of the original approach.

10 The historical one-year volatility for equities and bonds is equal to 16.10% and 7.56% in June 2008 and 11.43% and 5.38% in July 2013.

11 These figures are obtained by using a 99.9% Gaussian value-at-risk measure where the expected returns are equal to the one-year moving average trends.

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