PUBLISHED BY | AUGUST 2014 • VOLUME 1, NUMBER 4 | A SUPPLEMENT TO PENSIONS & INVESTMENTS

P&I CUSTOM MEDIA GROUP

Research for Institutional Money Management

EDHEC-RISK Institute

INTRODUCTION

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It is a great pleasure to introduce the latest edition of the EDHEC-Risk Institute Research for Institutional Money Management supplement in cooperation with Pensions & Investments.

We start by comparing the effects of different measures a regulator can use to reduce volatility in financial markets. Regulators aim to maintain stable financial markets because reducing financial market volatility has a positive impact on the growth rate of the economy. The three measures studied are the financial transaction tax (FTT or Tobin tax), short-sale constraints and leverage constraints.

We review the state of the art in fixed-income performance attribution analysis, covering performance attribution models and peer analysis. Evaluation based on performance attribution analysis provides insight for assessing management teams both for clients and the chief investment officer of the firm. The models are not perfect but they do provide far more insight about the investment skills of managers than single-index performance measures and peer-group analysis.

Looking at optimal dynamic-allocation-based portfolio insurance for long-term investors using Constant Proportion Portfolio Insurance (CPPI), we report significant potential benefits in terms of performance and risk reduction when compared to using an optimal time-varying multiplier parameter and a safe asset different from cash.

We examine the role that global cash flows can play in asset allocation. The research finds that the incorporation of cash-flow and dispersion risk considerations, when making region-based investment decisions and designing portfolios at a global level, leads to more targeted and appropriate portfolio allocations, which are tailored to the levels of risk and return that investors intend to achieve.

In exploring dynamic portfolio construction techniques we consider the case of funds of hedge funds, asking whether it is possible to control for downside risk when the market environment is changing. If so, is it possible to mitigate risk without compromising long-term growth prospects, and do the potential benefits from dynamic portfolio construction stand up to the test of real-life portfolio management?

The benefits of including commodities in multi-asset portfolios have been questioned in recent academic papers that argue that increased investment in commodities has heightened the correlation between commodities and traditional asset classes and, as a result, has reduced the diversification benefits associated with commodity investing. In our article we contribute to this debate by empirically examining the benefits of including commodities in an investor portfolio. The evidence suggests a clear role for commodity factor portfolios but not the commonly used S&P GSCI-based commodity portfolios.

Continuing on the theme of commodities investing, 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 at the importance of the shape of crude-oil futures curves. Crude-oil futures contracts typically traded in backwardation (with a near-month futures contract trading at a premium to deferred-delivery futures contracts) during the 1990s. From 2004 to 2007, however, the contracts traded in contango (with the front-month price trading at a discount to the deferred-delivery contract). This raises the question of whether there is now a return to the backwardation norm of the 1990s.

We would like to sincerely thank our partners at Pensions & Investments for their continuing collaboration on this supplement and hope that you will find our insights both interesting and relevant.

CONTENTS

PORTFOLIO MANAGEMENT

INDEXES

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PORTFOLIO MANAGEMENT

Financial Regulation: Comparing Different Measures to Control Stock Market Volatility

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Whenever there is a crisis in financial markets, there is a call for greater regulation of these markets and the financial institutions that operate in these markets. It is not clear, however, whether more tightly regulated markets would also be more stable, or whether they would function better than those that are less tightly regulated. In fact, Lo (2012) reviews 21 books on the crisis, of which 11 are written by academics and 10 by journalists and a former Treasury Secretary, and finds that there is little agreement among these books; they disagree about the events characterizing the financial crisis, the factors explaining the cause of the crisis, and hence, the appropriate measures to deal with the crisis.[2]

A key objective of regulators is to maintain stable financial markets, because reducing the volatility in financial markets has a positive impact on the growth rate of the economy. Stability of financial markets can be achieved using fiscal and monetary policy measures along with direct restrictions on trading in financial securities. In this article, we compare the effects of different measures a regulator can use to reduce the volatility in financial markets. The three measures we study are the Tobin tax on financial transactions, constraints that limit or prohibit short sales, and constraints that limit leverage.

All three measures we study have recently been proposed by regulators in Europe. For example, on August 1, 2012, France introduced a financial transaction tax of 0.20%. The tax on financial transactions was first proposed in Tobin (1974). This tax is based on the view that excess volatility in financial markets is the result of trading by speculators; thus, even a small tax on financial transactions would slow down the trading activity of speculators and reduce volatility.[3] On July 25, 2012, Spain's Comisión Nacional del Mercado de Valores (CNMV) imposed a three-month ban on short-selling stocks, while Italy's Consob prohibited short-selling of 29 banks and insurance stocks; tighter leverage constraints have been proposed following the subprime crisis, for instance, Reuters reported on October 17, 2008, that European Commissioner Joaquin Almunia said: "Regulation is going to have to be thoroughly anti-cyclical, which is going to reduce leverage levels from what we've seen up to now."[4]

The questions we address are: If a regulator wishes to reduce the volatility of stock markets that it judges to be in excess of fundamental volatility, should it introduce a Tobin tax, short-sale constraint, or borrowing constraint? Which regulatory measure has the strongest effect on the volatility of stock market returns? The spillover effect of each of the three regulatory measures on other quantities in the economy is also important. The quantities we consider are real variables, such as output and investment, and also financial variables, such as the level of the stock market and the interest rate.

To answer these questions, we develop a dynamic stochastic general equilibrium (DSGE) model of a production economy that is populated by multiple investors who have different beliefs; some of these investors are fully rational but others may trade on sentiment; the sentiment-prone investors are modeled as having incorrect priors. Trading among investors who differ in their beliefs leads to asset returns that are excessively volatile, as has been documented empirically.[5] Regulation is justified only in the presence of such a market imperfection and where the costs of regulation do not exceed the benefits. Therefore, to justify regulatory intervention one needs to understand the nature of the market imperfection and to assess whether it is possible to address that market imperfection with a regulatory measure that has a positive benefit, net of the costs of regulation.

Our model has two central features. The first is the presence of investors with heterogeneous beliefs, rather than a representative investor. Both policymakers and academics have recognized the importance of studying models with heterogeneous investors with different beliefs. For instance, Stiglitz (2010b) criticizes representative-investor models and highlights the importance of heterogeneous investors as a key challenge. Hansen (2010) lists one of the challenges for macroeconomic models to be "Building in explicit heterogeneity in beliefs, preferences …", and Hansen (2007) in his Ely lecture says: "While introducing heterogeneity among investors will complicate model solutions, it has intriguing possibilities." Sargent (2008), in his presidential address to the American Economic Association, discusses extensively the implications of the common beliefs assumption for policy. To model heterogeneous beliefs, we use the approach in Dumas, Kurshev, and Uppal (2009), who have a setting similar to that in Scheinkman and Xiong (2003) with investors who hold heterogeneous beliefs except that all investors are risk averse. Thus, in the eyes of each investor, the behavior of the other investor(s) seems unreasonable and is seen as a source of risk, which requires a risk premium and which originates in the financial market itself, over and above the source of risk originating from the production system.

The second central feature of our model, once regulatory constraints are introduced, is market incompleteness and frictions. In the presence of regulatory constraints, financial markets are no longer complete or frictionless; therefore, identifying the equilibrium in the dynamic economy is difficult because it requires one to solve a forward–backward system of difference equations. We, however, build on the method developed by Dumas and Lyasoff (2012) to show how, even in the presence of a variety of regulatory constraints, the system of forward–backward equations can be reduced to a system of backward (recursive) equations.[6]

These two central features of the model allow us to meet the twin challenge set by Eichenbaum (2010), who noted that the dynamic stochastic general equilibrium models developed and used by macroeconomists "did not place much emphasis on financial market frictions." The twin challenges he presented were to model heterogeneity in beliefs and persistent disagreement among investors on the one hand and financial market frictions with risk residing internally in the financial system rather than externally in the production system. The twin challenges are met here because the heterogeneity of investor beliefs is a fluctuating, stochastic one so that it constitutes, indeed, an internal source of risk.

The presence of sentiment-prone investors has negative consequences for the real sector in the economy. Sentiment-prone investors, because they have the wrong assumptions, introduce an additional source of risk in the economy. A consequence of this risk is that real investments become more risky, and hence, there is a drop in investments and a resulting decrease in the growth rate of the economy. This additional source of risk from the trading of sentiment-prone investors is reflected also in the financial sector, in the form of a higher volatility of stock-market returns.

Given that the main imperfection in our model arises from the trading of sentiment-prone investors, the measures introduced by the regulator need to be effective in targeting the decisions of these investors. The major finding of our paper is that, of the three measures we consider, only the leverage constraint is effective in reducing stock-market volatility and this is accompanied by positive effects on the real sector: an increase in the levels of consumption growth and investment growth, and a decrease in their volatilities. In contrast, both the Tobin tax on financial transactions and constraints on short sales are ineffective; in fact, they lead to a small increase in the volatility in financial markets and have negative effects on the real sector: a decrease in the growth rates of output and investment and an increase in the volatility of consumption growth.[7]

To understand why leverage constraints are effective in ameliorating the effect of sentiment-prone investors, note that in order to speculate on their beliefs, which differ from the beliefs of the fully rational investors, leverage is needed. That is, if sentiment-prone investors are over-optimistic or overconfident about the equity market, then the only way they can finance this speculative position is by leveraging their portfolio. On the other hand, if the sentiment-prone investors are pessimistic about the equity market, then they would like to reduce the proportion of their wealth invested in the market and increase the proportion of wealth in the riskless asset, which in general equilibrium where the bond market must clear, implies that the rational investors are willing to borrow. If there is a constraint on leverage, then it

[1] The work described in this article is based on joint research with Adrian Buss (INSEAD), Bernard Dumas (INSEAD, CEPR, and NBER), and Grigory Vilkov (Goethe University Frankfurt).

[2] The academic authors are: Acharya, Richardson, van Nieuwerburgh, and White (2011), Akerlof and Shiller (2009), French, Baily, Campbell, Cochrane, Diamond, Duffie, Kashyap, Mishkin, Rajan, Scharfstein, Shiller, Shin, Slaughter, Stein, and Stulz (2010), Garnaut and Llewellyn-Smith (2009), Gorton (2010), Johnson and Kwak (2010), Rajan (2010), Reinhart and Rogoff (2009), Roubini and Mihm (2010), Shiller (2008), and Stiglitz (2010a). The non-academic authors are: Cohan (2009), Farrell (2010), Lewis (2010, 2011), Lowenstein (2010), McLean and Nocera (2010), Morgenson and Rosner (2011), Paulson (2010), Sorkin (2009), Tett (2009), and Zuckerman (2009).

[3] Positions taken by hedge funds (for instance, the fund managed by George Soros) in currency markets were blamed for the devaluation of the British pound and the French franc in 1992–93. Speculators were also blamed for the crises in South-East Asia in 1997, in Russia in 1998, in Brazil in 1999, and Argentina in 2001. The high volatility in equity and credit markets during the recent financial crisis has also been blamed on the activities of speculators.

[4] For a review of research on the Tobin tax, see Anthony, Bijlsma, Elbourne, Lever, and Zwart (2012) and McCulloch and Pacillo (2011); for a review of the literature on short-sale constraints, see Beber and Pagano (2013); and, for a review of studies on regulatory constraints on leverage, see Crawford, Graham, and Bordeleau (2009).

[5] See Shiller (1981).

[6] There exists a vast literature on methods to solve general equilibrium models (see, for example, the special issue of the Journal of Economic Dynamics and Control, 2010, vol. 1).

[7] There is also a substantial body of empirical work studying the effect of a transactions tax on volatility of the price of financial securities. Most of these papers find that a transaction cost either fails to reduce return volatility, or leads to an increase in volatility.

reduces the ability of sentiment-prone investors to hold a portfolio that is different from the portfolio held by the fully rational investor and in the limit, if no leverage is allowed, then the sentiment-prone investors have no choice but to hold the same portfolio as the fully rational investors, which nullifies the effect of differences in beliefs. Thus, leverage constraints have a strong effect in curtailing the effect of sentiment-prone investors.

Next, let us consider short-sale constraints. Short-sale constraints bind only when an investor wishes to hold less than zero shares of the market; thus, these constraints bind much less frequently, and hence have smaller bite than leverage constraints. Finally, the Tobin tax affects the portfolio policies of investors by changing the cost of adjusting portfolio positions, as opposed to restricting the portfolio position itself. Because the Tobin tax is small, typically less than 50 basis points, it will have only a small effect on equilibrium quantities. Moreover, the Tobin tax can have negative consequences because it restricts the ability of investors to rebalance their portfolios over time in order to smooth out how much they consume.

In summary, our analysis allows quantitative assessment of the direct and indirect effects of regulatory measures such as the Tobin financial transaction tax, constraints on short sales, and constraints on leverage. It makes it possible to compare these measures and understand how they influence stock market volatility, output growth rate and its volatility, the interest rate level and its term structure, trading volume and liquidity in financial markets. Our main finding is that, while limits on leverage are effective in curtailing the volatility of returns in the stock market, a tax on transactions and constraints on short sales are largely ineffective and can have negative side effects on the real sector. ~

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PORTFOLIO MANAGEMENT

Fixed-Income Performance Attribution Analysis and Other Performance Evaluation Approaches

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Clients of asset management firms need to know more than just whether or not a portfolio manager outperformed a benchmark and, if so, by how much. They need to know the reasons why a portfolio manager realized the performance relative to the benchmark, which can be either a bond index, smart beta, or a customized index. The difference between the portfolio return and the benchmark return is referred to as the active return. For example, suppose a pension fund engaged an external manager based on the manager's claim that alpha can be achieved using security selection. Suppose further that the manager did have a positive active return. Did the manager generate alpha using the strategy stated when he or she was retained? The active return alone gives no hint as to its generation because it is not known what specific risks relative to the benchmark the manager took to generate the positive active return. It is entirely possible that the outperformance was attributable to being mismatched against the benchmark's duration (i.e., the manager bet on interest rate risk and it paid off). In fact, it is possible that the manager could have outperformed the benchmark because of a duration mismatch but invested in specific securities that did poorly relative to the benchmark. There is no way that the client can determine that by simply looking at the active return.

Clients need information about why the portfolio's return differed from that of the benchmark, but so does the CIO at the asset management firm engaged by the client. The firm will determine bonuses to members of the portfolio management team based on performance. Breaking down the performance to the team-member level is important for this purpose as it affects decisions about the advancement and retention of such personnel.

Although useful in some contexts, single-index performance measures such as the Sharpe ratio, Treynor measure, and information ratio do not provide sufficient information about performance to address the two questions posed earlier. The model that can be used to address the two issues is performance attribution analysis, a quantitative technique for identifying the sources of portfolio risk relative to a benchmark as well as performance evaluation so that the contributions of members of the portfolio management team can be measured and the impact on return of major portfolio decisions can be quantified.

Attributes that a good performance attribution model should have

There are several fixed-income performance attribution models that are available from vendors and analytical systems developed by dealer firms. (Some of the larger asset management firms have developed their own models.) There are certain characteristics that a good third-party attribution model should possess so that the decision-making ability of the members of the portfolio management team can be evaluated: additivity, completeness, and fairness.[8] Additivity means that the contribution to performance of two or more decision makers of the portfolio management team should be equal to the sum of the contributions of those decision makers. Completeness means that when the contribution to portfolio performance of all decision makers is added up, the result should be equal to the contribution to portfolio performance relative to the benchmark. The decision-making process is one that involves the interaction of many members of the portfolio management team. Fairness means that the portfolio management team members should view the performance attribution model selected as being fair with respect to representing their contribution.

Types of performance attribution models

There are three types of performance attribution models: sector-based, factor-based, and hybrid sector-based/factor-based models. The simplest model is the sector-based attribution, also referred to as the Brinson model. In this model, the portfolio's active return is divided into two decisions: (1) how to distribute funds among the different sectors of the bond market and (2) how to choose the specific securities within each bond sector. Factor-based attribution models start with a factor (risk) model that can be used to construct a portfolio. The purpose of a factor model is to determine the key common drivers of returns and their risks for the benchmark; this information can be used to construct a portfolio in which the tracking error can be controlled. These common factors are referred to as systematic risk factors. For fixed-income portfolio management, the primary systematic risk factors for a U.S. benchmark can be separated into yield curve risk (changes in the level and shape of the yield curve risk) and non-yield–curve risks. The latter include swap spread risk, volatility risk, government-related spread risk, corporate spread risk, and securitized spread risk. There will be non-systematic risk in the portfolio that will be included in even the best diversified fixed-income portfolio. The non-systematic risk includes issuer risk and issue risk. This will occur simply because with 6,000 plus securities in a typical bond index, a far smaller number of issues will be included in the portfolio.

As the name suggests, a hybrid sector-based/factor-based attribution model combines the previous two models. The hybrid allows for much more detail regarding not only the bets on the primary systematic risk factors driving returns but also the impact of decisions with respect to sector and security selection. The level of detail in such models depends on the client.

Peer analysis

Peer analysis involves comparing the performance of managers of similar funds, funds that have the same benchmark and constraints (degree of leverage permitted). Regrettably, as currently conducted, peer analysis is a major step backwards in the evolution of performance evaluation analysis. One problem is that peer analysis is performed either by ranking the active returns of the members of the peer group and ignoring risk or by ranking according to some single-index performance measure. This masks the package of the risks relative to the benchmark that the managers of the funds in the peer group bet on. By ignoring how the active return is generated, the pack will be led each period by the most aggressive managers. For example, in the 1990s there were several mutual fund managers whose performance for so-called limited duration funds considerably outperformed those in their peer group. A subsequent analysis performed by expert witnesses in SEC hearings and private litigation showed that these funds had a duration that was so much greater than those in the peer group that, in a declining interest rate environment, they were the industry leaders. When rates increased, they were the worst performing managers, sustaining considerable losses for shareholders. For marketing purposes, peer group analysis is used for mutual funds, as well as for retention of managers and fee determination. When using peer analysis, the evaluation framework should be supplemented with the historical ranking of managers (using a measure such as rank correlation) to determine consistency in performance.

The second problem is that it is not always simple to identify suitable members of a peer group. Typically, the peer group is provided by a third-party vendor so that a manager cannot be accused of cherry-picking the competition. Although a manager may, with the approval of the client, customize the peer group, a client will always be concerned with a manager picking the opponents. Probably the best example of the consequence of incorrect peer selection is in the closed-end fund space. There are closed-end funds that are target term trusts. Unlike other closed-end funds, these funds have a target maturity date by which the manager is supposed to return the initial investment. These funds are categorized by third-party vendors as some sort of long-term bond funds. At issuance, the managers of these funds invest in fixed-income assets that have high durations. Over time, the fund's duration is shortened so that as the fund approaches maturity, the duration is low to avoid tail risk. As a result, these funds should underperform when compared to other funds typically included in a peer group. In a period of declining interest rates, these funds should underperform on a total return basis because of their low duration. In such cases, superior performance relative to the so-called peer group should generate more concern than praise for the performance of the manager if alpha is generated solely from an interest rate bet. ~

CONCLUSION

Performance evaluation based on performance attribution analysis is helpful in assessing management teams for both clients and the chief investment officer of the firm. The models are not perfect but they do provide far more insight about the investment skills of managers than single-index performance measures and peer group analysis do. Unfortunately, for collective investment vehicles such as mutual funds and closed-end funds, the only information available to investors is historical active return, which can be used to calculate single-index measures. That information is insufficient to assure that fund managers are pursuing strategies that are stated in a prospectus. Regulators should be concerned with this issue and should seek to formulate a simple way to help investors understand the risks incurred by managers in seeking to generate alpha.

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PORTFOLIO MANAGEMENT

Dynamic-Allocation-Based Portfolio Insurance for Long-Term Investors

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Constant Proportion Portfolio Insurance (CPPI) was initially conceived as a capital guarantee product providing access to the potential benefit of a risky asset (Black and Jones, 1987). Through a dynamic allocation between the risky performance-seeking asset and a safe zero-coupon bond matching the investor's horizon, the strategy is designed to prevent the value of the portfolio falling below a floor value representing the minimum asset value level to insure.

The CPPI strategy can be adapted to different contexts by changing the definition of the floor and the safe asset. For instance, the CPPI strategy can be adjusted to an asset–liability management context, in which the investor is a pension fund that needs to match future retirement payments for its pensioners. In that case, the safe asset is a liability-hedging portfolio of long-term bonds matching the stream of the fund's future cash payment obligations and the floor is (a proportion of) the present value of liabilities. Investors hoping to beat a risky benchmark, such as a cap-weighted equity index, by investing in alternative beta strategies or active investment funds, can limit potential benchmark underperformance to a tolerance level set beforehand, using a benchmark-replicating portfolio as the safe asset and setting the floor of the CPPI strategy as a proportion of the value of the benchmark index.

Most studies of the multiplier of the CPPI[9] assume that the safe asset is a risk-free bond yielding a constant interest rate. In models without interest rate risk, long-term default-free bonds behave like a short-term savings account (i.e., cash). However, in practical applications such as the aforementioned, the safe asset and floor present dynamics very different from cash.

In a paper forthcoming in the Journal of Investment Management (Mantilla-Garcia, 2014), I address the question of the optimal parameterization of a set of portfolio insurance strategies structured similarly to the popular CPPI but with a time-varying multiplier parameter and a stochastic safe asset different from cash.[10] The paper reports significant potential benefits in using the optimal multiplier in terms of performance and risk reduction.

The paper also shows that using a floor-replicating asset different from an idealized risk-free bond with constant rate of return has several important implications for the behavior of this kind of asset allocation strategy. First, the optimal multiplier of the strategy is time-varying instead of constant, especially when interest rates vary.[11] Second, the somewhat surprising impact of the correlation between the risky asset and the safe asset on the growth rate of the strategy and its multiplier is revealed. Third, in the presence of mean-reverting expected returns, the optimal multiplier introduces a counter-cyclical tactical component to the strategy that contrasts with the pure trend-following behavior of CPPI. Fourth, mean-reverting expected returns induce a strategic increase in the allocation to equities when the investment horizon is longer. These implications are consistent with common features of popular asset allocation advice from professional investment managers, such as the horizon puzzle and the risk-tolerance bond/stock allocation ratio puzzle reported by Samuelson (1994) and Canner, et al. (1997).

Portfolio insurance and the benefits of high correlation

Former studies on the multiplier of CPPI use a deterministic risk-free bond paying a constant rate of return as the safe asset. In an unrealistic case of that kind there is no correlation between the strategy's safe asset and the strategy's risky asset. On the other hand, when a more general model is used for the safe asset, its correlation with the risky asset matters. To see this, consider the strategy's cushion process, which is defined as the difference between the value of the portfolio and the value of the floor process at each point in time. The higher the value of the cushion, the higher the value of the portfolio. Exhibit 1 (Mantilla-Garcia, 2014), presents the growth rate of the cushion process of a portfolio insurance strategy investing in an equity index (risky asset) and a zero-coupon bond with a 5-year maturity (safe asset), as a function of the correlation between the two assets (left panel) and the multiplier (right panel).[12]

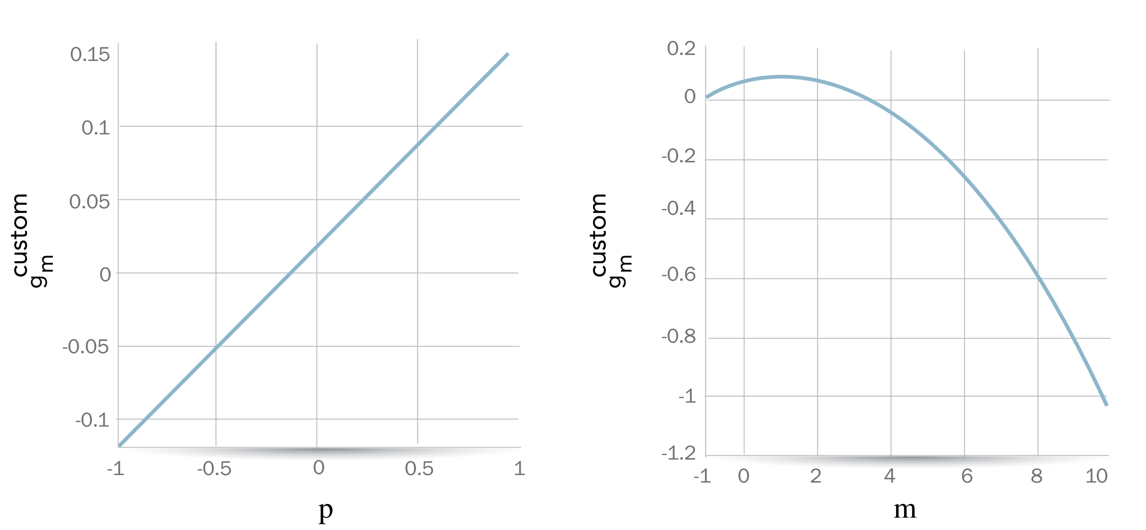
Two phenomena stand out in the illustrations in Exhibit 1. First, a higher correlation between the risky asset and the safe asset induces a higher growth rate for the value of the cushion process, everything else being equal.[13] Second, increasing the value of the multiplier does not always imply an increase in the growth rate of the value of the cushion process and in fact large multiplier levels may imply a negative rate of growth.

It is well known that, there is usually a diversification benefit for portfolios with assets presenting lower correlations. For instance, the correlation between the two assets in an asset allocation strategy constantly trading to maintain constant (positive) weights would have a negative impact on the growth rate of the portfolio (see Booth and Fama, 1992; Fernholz, 2002). However, this negative impact of higher correlations only holds for unleveraged portfolios with positive weights. It can be shown that the dynamics of the CPPI cushion are equivalent to a leveraged portfolio with a weight in the risky asset equal to the multiplier, m, and an allocation of 1-m to the safe asset, if m>1. For leveraged portfolios, the diversification effect of correlation is reversed, and using two assets with a higher correlation increases the value of the CPPI strategy. Intuitively, such a difference in the impact of correlation for unleveraged and leveraged portfolios is explained by the contrarian strategy of a constant-weighted portfolio with two assets, as it sells the former winner asset and buys the former loser asset to bring weights back to target. This kind of strategy contrasts with the trend-following behavior of a CPPI strategy. In mathematical terms, this positive effect of correlation is the result of the so-called relative variance cost of portfolio insurance strategies (see Mantilla-Garcia, 2014, for details), which decreases with the level of correlation between the two assets. This cost also increases with the level of the multiplier, which explains the results in Exhibit 1.

Optimal multiplier benefits

Assuming continuous-time trading and asset prices, in theory, such dynamic allocation strategies can insure their

EXHIBIT 1



[9] Including Black and Perold (1992), Basak (2002), Bertrand and Prigent (2002), Cont and Tankov (2009), Hamidi, et al. (2009), and Ben Ameur and Prigent (2013).
[10] Asset-allocation–based portfolio insurance strategies such as CPPI are structured with two main components: the performance constraint risk budget and a multiplier parameter that determines the allocation to risky assets per unit of risk budget.
[11] Time-varying expected returns, volatilities and correlations also imply a variable optimal multiplier.
[12] In Exhibit 1, the 5-year zero-coupon bond follows a Vasicek (1977) model and parameter values for both the bond and the stock index are from Munk, et al. (2004).
[13] Note that the correlation between the two assets has nothing to do with the correlation between the floor and the safe asset. The correlation between the floor and the safe asset in the case of the CPPI is usually equal to 1 or very close. In the latter case there is basis risk in the liability-hedging portfolio.

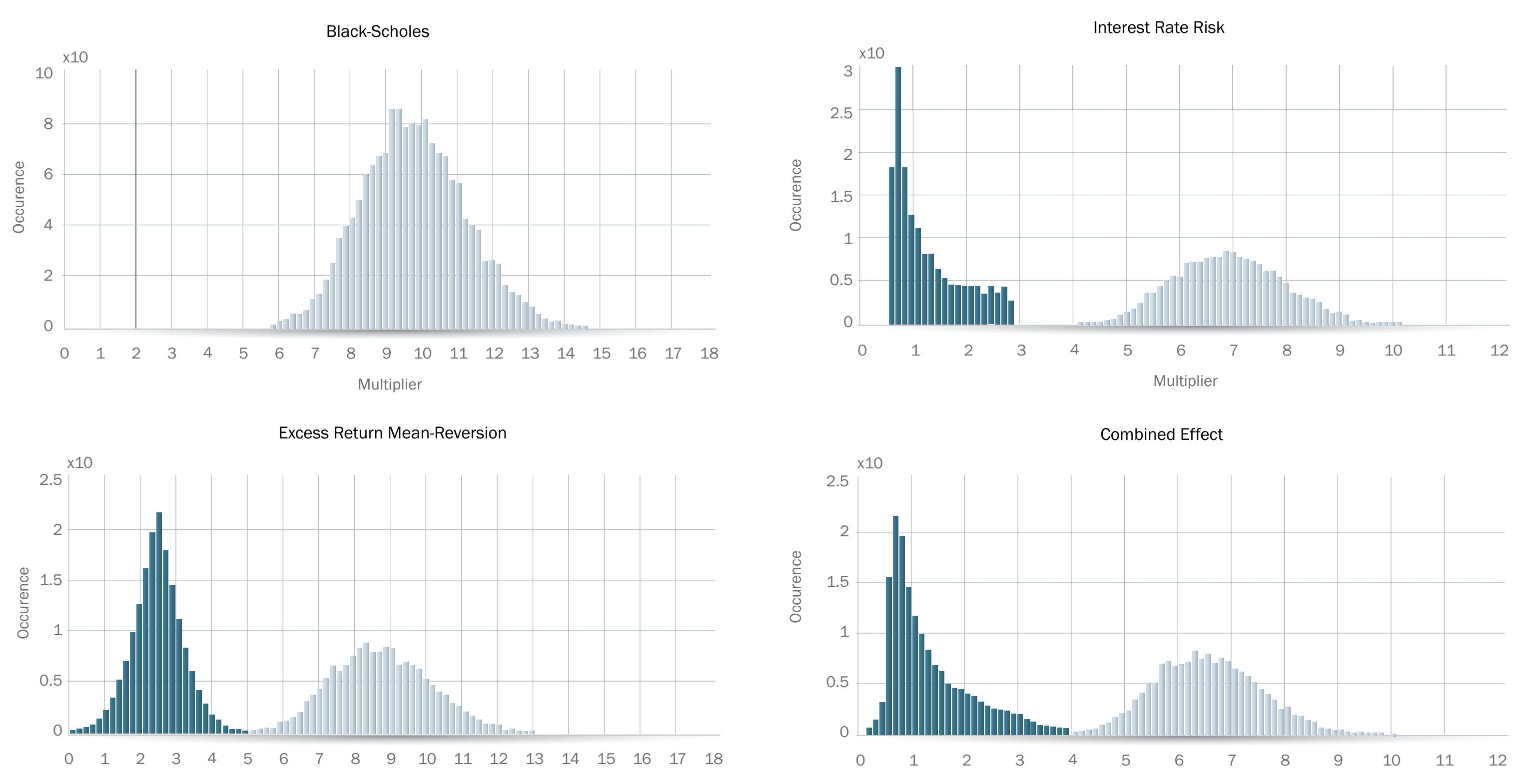
performance constraint for any multiplier value. However, in practice trading can only happen in discrete time and asset prices may jump. Several related papers, such as Bertrand and Prigent (2002), Cont and Tankov (2009), Hamidi, et al. (2009), and Ben Ameur and Prigent (2013) have focused on estimating the maximum multiplier or upper bound that would allow such a strategy to cope with its risk-management objective, even in the worst case, at a given confidence level.

Mantilla-Garcia (2014) reports important potential benefits in terms of excess performance and risk reduction in using the growth-optimal portfolio insurance (GOPI) strategy with an optimal multiplier relative to the standard CPPI with a constant maximum multiplier. In stochastic simulations, outperformance probabilities are between 60% and 97%, depending on the model configuration considered, and median outperformance figures over long horizons are up to 6% a year. The performance comparison is done for the GOPI and CPPI strategies with the same constraint on terminal wealth and with the same underlying assets. Thus, the two strategies have a similar risk profile, as measured by the worst possible outcome of terminal wealth.

Interestingly, the level of the optimal time-varying multiplier turns out to be lower than the maximum constant multiplier of CPPI for common parameter values. Exhibit 2 (Mantilla-Garcia, 2014) presents the distribution of the optimal (darker shade) and maximal (lighter shade) multipliers across time and over the 10,000 scenarios of 15 years of monthly data in four different model configurations, namely, a Black-Scholes model with constant parameter values, a model with interest rate risk (Vasicek bond), a model with mean-reverting expected returns in the equity index (as in Munk, et al., 2004) and a model with both interest rate risk and time-varying expected returns. As the exhibit shows, for all model configurations the optimal multiplier is lower than the maximal multiplier in virtually all situations in most configurations. As a consequence, the GOPI strategy presents an important reduction in maximum drawdown relative to the CPPI.

There is significant evidence in the academic literature that expected returns in equity markets are time-varying and present mean reversion (see for instance Pastor and Stambaugh, 2009). Hence, expected returns in equities tend to increase following a series of negative realized returns and vice-versa. In the presence of mean-reverting excess returns, the optimal multiplier presents a counter-cyclical dynamic, as after a period of negative realized returns, expected excess returns of the risky asset would increase and the optimal multiplier would be relatively higher than at the beginning of the bear market, anticipating the higher returns. Indeed, in the stochastic simulations reported in Mantilla-Garcia (2014), the relative change of the optimal multiplier during the maximum-drawdown period of the stock index is always positive and, in models with mean-reverting expected returns, the optimal multiplier presents variations between +20% and over +92% during the MDD period of the equity index. This large increase contrasts with the constant multiplier (zero relative change) of the standard CPPI strategy. ~

EXHIBIT 2



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INDEXES

Global Cash Flows as a Valuable Asset Allocation Tool

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The difficulties encountered by classic asset-pricing theory in explaining asset returns behavior have been extensively documented in the literature. The level of returns observed empirically does not support the premise that risk premia are driven by an asset's covariance with macroeconomic factors. The degree of equity market coincidence with the economy is not sizeable enough to justify the high risk premia observed, even under the assumption of high levels of risk aversion. Furthermore, cross-sectional pricing anomalies such as the value or size premia are left unexplained by most traditional models, notably the consumption CAPM model. Growing awareness of this fact has quickly and increasingly prompted the asset pricing community to devise more convincing theories that can more realistically delineate the behavior of asset returns. Practitioners also devote significant attention to the topic, since understanding the pricing mechanism prevailing in markets is at the very heart of finance and its functioning.

A number of theories have proved successful, including theories involving time-varying preferences (Merton, 1973), factor models (Fama and French, 1992), beta decomposition (Campbell and Vuolteenaho, 2004), long-term considerations (Bansal and Yaron, 2004), predictability (Lettau and Ludvigson, 2001), consumption heterogeneity (Constantinides and Duffie, 1996), investor behavior, and many others. Most of them, however, were largely devoted to studying pricing at a domestic level, mostly the U.S., for example Bansal, Dittmar and Lundblad (2005), and rarely at an international level. International pricing discrepancies remained somewhat unexamined, despite its growing relevance throughout the last decades. Region-based investment decisions and international strategic asset allocations are a reality, and the questions of where to invest and how to build a globally diversified portfolio are the topic of many financial discussions nowadays.

There is obviously a reason why there have been more asset pricing studies at a domestic level: international studies need to deal with extra layers of complexity. Special care must be taken with the assumptions incorporated into the model, especially in relation to the degree of market integration and risk sharing assumed, the pricing factors to be used and the role of currency risk.

An analysis carried out by Almeida (2013) in an attempt to shed light on the mechanisms of price formation globally, studied cash flow risk and heterogeneous agents theories from an international standpoint. In the study, utility was assumed to be derived from world aggregate consumption; therefore, world consumption dynamics were considered important determinants of the stochastic discount factor.

The theoretical motivations were simple and clearly delineated: countries whose aggregated cash flows (measured in the form of aggregated earnings or dividends, for example) coincide more intensely with the state of the economy should be proportionally rewarded because of their higher vulnerability to global business cycles. In practice, investors require a smaller equity premium to invest in assets whose aggregated cash flows are either less correlated with consumption growth or whose dividend yields or capital gains earned are more stable and thus more predictable over time. In an international context, that would mean investors are less averse to investing in countries that generate consistent flows over time, somewhat shielded from global market turbulences. Thus, countries associated with lower price-to-cash-flow measures (P/D or P/E, for example) should pay higher risk premia, as investors discount their valuations because of their greater vulnerability. Those countries would represent the concept of value, normally applied to stocks and companies. Under that premise, aggregated cash flows are priced in the global economy and investors are thus compensated for bearing this risk, justifying the higher long-term performance verified in countries displaying value.

If it is indeed the case that aggregated cash-flow risk yields valuable information about countries' expected returns, why should this be true? There are several answers: to maintain a smooth consumption pattern over time, investors prize securities that offer a somewhat stable stream of income, regardless of market circumstances. Those securities act as insurance during recessionary times, and for this reason investors happily accept lower returns in exchange for this stability. The opposite holds true for companies whose earnings tend to vary more intensely with the state of the economy, and investors in such cases not only demand higher returns from their investments but are ready also to disinvest from those securities in turbulent times.

The same phenomenon can be transposed to an international setting: countries that render a stable income flow over time tend to deliver steadier tax revenues on average, more sustainable debt management, lower levels of interest rates paid on government debt, and positive spillovers on country credit quality as a result. On the other hand, investors demand higher rates of return from countries that are more sensitive to the state of the global economy, and are more likely to remove their investments from those countries in periods of crisis, seeking more defensive, safe-haven regions instead—the flight to quality phenomenon. This leads to a sharper liquidation and greater exposure of such countries to liquidity risk. Those countries, associated with the concept of value, are normally considered to have relatively higher distress risk, being as a result punished by investors with higher discount rates, lower prices and therefore higher expected returns. Emerging markets are traditionally examples of countries in such a category.

An additional dimension of cash flow dependency was investigated: does the exposure of aggregated cash flows to global consumption dispersion, here defined as a proxy for agent heterogeneity, explain asset behavior internationally? If certain risks in the economy cannot be insured (unemployment or divorce, for example), individuals become exposed to idiosyncratic risk shocks; the cross-sectional variance of consumption growth is priced as well. The reasoning is that countries' exposure to international variability in idiosyncratic shocks should also matter: countries whose cash flows are more sensitive to circumstances when international consumption levels diverge tend to deliver higher risk premia, on average, according to the theory.

In light of the above, cash-flow betas and associated prices of risk were estimated for countries or P/D-sorted country portfolios by applying the Fama-MacBeth technique to 18 countries. Estimations were done in unconditional or time-varying settings, based upon the assumption of fully integrated markets and the existence of a US$-based investor who holds investments in stock markets around the world and who cares about world consumption risk and on resulting foreign exchange exposure. Two cash flow proxies were considered: aggregated dividends and aggregated earnings. Two different consumption measures were used: world total private consumption expenditure in US$ real terms or in purchasing power-adjusted terms (so as to correct for purchasing power differences among countries).

Among the conclusions, it could be verified that the potential risks carried by cash flow dependencies on the evolution of a long-term, smoothed measure of global consumption growth are able to explain a significant portion (up to approximately 60%) of the cross-section of country returns, with significant betas and prices of risk. This is in stark contrast to the very weak performance of the traditional consumption CAPM model. Dividends appear as a more efficient measure than earnings of cash flows, and grouping countries into P/D-sorted portfolios tends to deliver more precise and understandable estimates. Estimations using PPP-adjusted world consumption measures delivered more consistent results. Low P/D countries show higher returns on average as investors expect higher rewards given their higher cash-flow risk. This is, in turn, reflected in their resulting higher cash-flow betas, thus suggesting the validity of adopting cash-flow risk as a fundamental measure for country returns. Furthermore, it was shown that countries' exposure to cross-sectional consumption dispersion significantly affects global returns. The dependence of country cash flows on global cross-sectional consumption variability seems to help determine risk premia as well.

There is strong evidence that countries' cash-flow exposures to the variability in global business cycles and idiosyncratic shocks are some of the determining factors for risk premia levels. These findings support the incorporation of cash-flow and dispersion risk considerations when making region-based investment decisions and designing portfolios at a global level, leading to more targeted and suitable portfolio allocations, tailored the level of risk–return expected by the investor. By strategically overweighting high-cash-flow–beta countries (or P/D-sorted country portfolios) in global portfolios, higher risk premia can be expected to be collected over the long term. By conditionally rotating between high- and low-cash-flow–beta countries (or P/D-sorted country portfolios) as a function of global market conditions, one can expect to achieve superior returns over the short to medium term. ~

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INDEXES

The Benefits of Dynamic Portfolio Construction: Mirage or Reality?

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Capital markets have undergone profound changes in recent decades. Among these changes, the speed of information transmission has certainly been one of the most significant. All market participants now receive pretty much the same information at the same time. They can react to changes in the information set and gain exposure to virtually any asset at lightning speed. The time for analysis has therefore shrunk and uncertainty has become the new norm.

A natural human inclination in a fast-moving environment is to move faster, in order to keep in step. In a portfolio context, this translates into the temptation to implement dynamic portfolio construction techniques. But is it really possible to control for the (downside) risk when the market environment is constantly changing? If so, is it possible to mitigate risk without compromising long-term growth prospects? Do the potential benefits from dynamic portfolio construction stand the test of real-life portfolio management?

We will consider the case of funds of hedge funds (FoHF) in this article. The risk factor exposures of hedge fund strategies and, as a result, their risk/return profiles, depend not only on market changes, but also on the underlying managers' idiosyncratic views. The level of risk of the different funds, as well as their relationship with the other funds, is therefore likely to change constantly. Adopting a dynamic approach at the FoHF level therefore appears to be relevant, if not necessary, to deal with such a time-dependent parameter.

Data

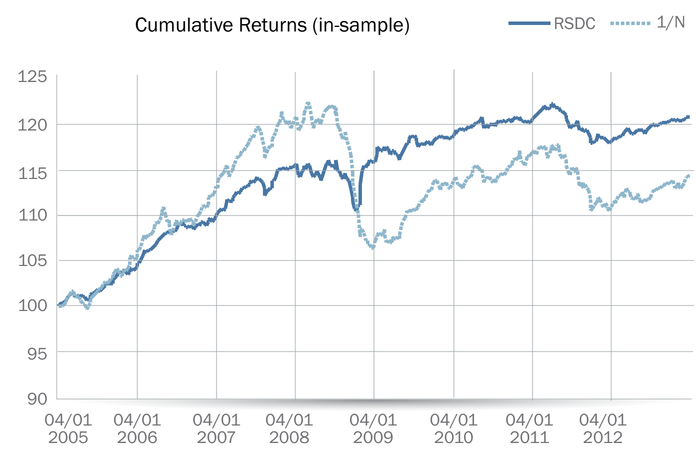
Two practical challenges are faced when manipulating hedge fund data. First and foremost, the quality of the publicly available information is questionable. There is ample evidence in the academic literature that the information provided by commercial databases is influenced by performance measurement biases (survivorship, selection, instant history). Hedge fund performance data are therefore not always representative of the performance an investor would actually have obtained. Second, hedge funds typically calculate net asset values on a monthly basis. It therefore takes years to collect a meaningful number of data points. Since most hedge funds have a short history, empirical studies are frequently conducted on a very limited number of observations. The estimation risk is therefore exacerbated.

In order to tackle these two issues, we use the hedge fund strategy indexes provided by Lyxor. The specific characteristic of these indexes is that they comprise only managed accounts. The quality of the data is, as a result, as good as it can be. And, the indexes offer weekly liquidity, with virtually no friction (no entry/exit fee for institutional investors). Our sample therefore contains 418 weekly observations. It would have taken 35 years to collect the same number of observations with traditional hedge funds. Our sample covers the most eventful period since the Great Depression, with a series of bull markets and significant corrections, a risk on/risk off environment, a banking crisis, and a sovereign debt crisis.

Assessing the benefits of dynamic portfolio construction

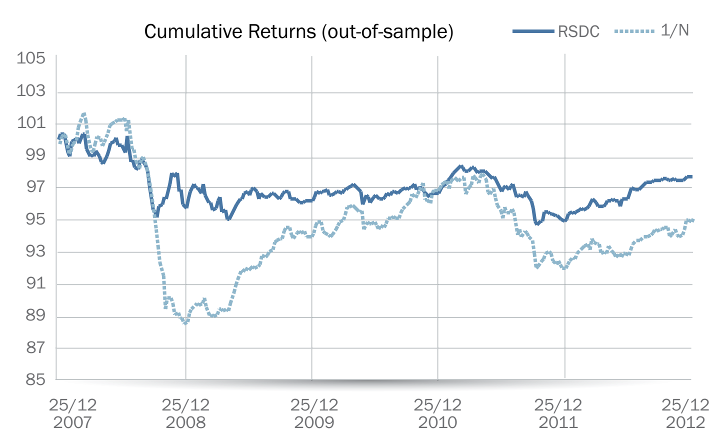
Several models have been introduced in the literature to describe the dynamics of the variance and the correlation of asset returns. Engle (2002) proposes, for example, a generalization to multivariate time series of the ARCH/GARCH approach first introduced in Engle (1982). However, this approach is anything but straightforward and generally leads to an acute dimensionality problem. The most popular multivariate volatility model is certainly the constant conditional correlation (CCC)

EXHIBIT 1



Source: Darolles and Vaissié (2014)

EXHIBIT 2



Source: Darolles and Vaissié (2014)

model introduced in Bollerslev (1990), but the hypothesis of constant correlations embedded in this model is rarely supported by the data. Pelletier (2006) therefore extended the CCC specification by introducing a regime switching dynamic correlation (RSDC) model. Starting with the same distribution of covariance matrices, Pelletier (2006) specifies a dynamic process for the correlation matrices (a regime switching model). Giamouridis and Vrontos (2007) test different static and dynamic covariance/correlation models and compare the out-of-sample performance of the optimized portfolios in the context of hedge fund portfolios. They find that the RSDC model both reduces portfolio risk and improves the out-of-sample risk-adjusted performance.

We build on Giamouridis and Vrontos (2007) and apply the RSDC model to the weekly returns of the 14 Lyxor hedge fund strategy indexes from January 4, 2005 to December 31, 2012. We only impose two constraints on the optimization: the portfolio constraint (weightings have to add up to 1), and the short sale constraint (weightings must be positive).

In order to isolate the benefits of the RSDC model, we focus on the one portfolio for which no information on expected returns is required; that is, the portfolio with the minimum amount of risk. For the sake of simplicity and in an attempt to control for the estimation risk, we chose the mean-variance framework and consider the minimum variance portfolio. The risk dimension is therefore assumed to be fully defined by the covariance matrix. The equally-weighted portfolio (the 1/N portfolio) is used only for comparison purposes, that is, to see how optimal diversification fares relative to uninformed diversification.

As can be seen from Exhibit 1 the behavior of the RSDC portfolio is impressive. The dynamic approach seems to be able not only to take advantage of the upside, but more importantly, to reduce the downside risk. The outperformance of the RSDC approach relative to the 1/N portfolio turns out to be considerable.

In practice, every new crisis comes with its share of new problems. Such appealing results may be obtainable only on an in-sample basis. We therefore did the very same experiment, except that this time we used an initial calibration period characterized by abundant liquidity and rising prices for risky assets all over the world (from January 4, 2005 to December 25, 2007). The investor therefore starts the out-of-sample period without knowing what a real storm might look like. The information set is then updated progressively, as the calibration period expands.

As can be seen from Exhibit 2, when investors do not already have all the relevant information sets and are receiving new information randomly, the results we obtain are qualitatively similar. The downside risk is very much contained, while the upside is partially achieved. The outperformance of the RSDC approach relative to the 1/N portfolio remains significant, even if the V-shape of the crisis (freefall followed by a sharp rebound in March 2009) plays very clearly in favor of the latter.

Robustness checks

In both the in-sample and the out-of-sample analyses we made the assumption that investors could change their allocation on a weekly basis with no limitations. In practice, however, rotating a portfolio implies visible (entry/exit fees, market impact) and invisible (relationship with the hedge fund manager) costs. Investors therefore control the turnover of their portfolios carefully.

Our first robustness check focuses on the impact of such control, and on the benefits expected to derive from the RSDC approach. We simulate the allocation changes an investor subject to a weekly portfolio turnover limit would have implemented and compare the outcome with the results for an unconstrained strategy. As can be seen from Exhibit 3, the drawdown increases and the average return decreases dramatically for a 5% limit. This first robustness check clearly shows that it is essential for investors to be able to rebalance the portfolio to a large extent in order to mitigate downside risk without compromising long-term growth prospects. While this might not be a problem with liquid instruments such as futures, it could be more of an issue with hedge funds.

So far, we have also made the assumption that investors are able to rotate their portfolios on a weekly basis. However, the liquidity terms of the Lyxor hedge fund indexes are unusual, and investors rarely have the option to rebalance their portfolios so frequently. Our second robustness check consists of assessing the impact of rebalancing frequency on the portfolio risk/return trade-off. We simulate the behavior of an investor able to change allocation every two to twelve weeks and compare the outcome with the unconstrained strategy. As can be seen from Exhibit 4, the impact is somewhat limited at four to five weeks but it tends to be significant after that. Unsurprisingly, the loss function is less linear than in the first robustness check. The drawdown tends to increase and the average return tends to decrease significantly, though, for a portfolio rebalanced every six weeks or less frequently. Notice periods and settlement issues make it fairly difficult in practice to reallocate FoHF portfolios every four to five weeks, so the rebalancing frequency might also be an issue.

In the previous experiments we assumed that investors react to new information in a timely manner, adjusting their strategy allocation as soon as practically possible. In practice, investors tend to react with a certain delay, usually because the decision-making process is slow. Our third robustness check assesses the impact of time-to-market on the portfolio risk/return trade-off. We simulate the behavior of an investor who incorporates new information with a delay of 1 to 12 weeks. In other words, instead of implementing the optimal weightings obtained on week W, the following week, and so forth, we do it from (W+2) to (W+13). Exhibit 5 shows that the cost of reacting with a one-week delay is reasonable, but it becomes significant with a two-week delay and is very substantial after that. The drawdown increases and the average return decreases here again substantially. ~

CONCLUSION

We have seen that although dynamic portfolio construction seems at first to deliver on its promise, a more careful analysis suggests that its benefits apply only to fast-moving investors dealing with liquid instruments; significant and unforeseen events may necessitate swift and even major adjustments of the portfolio structure. Implementing such a dynamic approach may be difficult over the long term as the underlying fund managers (and their investors) may be reluctant to hastily accept money from such unstable investors.

It appears that if FoHF managers want to seize the benefits of dynamic portfolio construction, they must tackle continual uncertainties directly. They need to be able to differentiate good risks from bad risks so that they can determine whether trading is the best way to maximize the risk-adjusted performance of the portfolio. The very same logic holds true for traditional portfolio managers.

Just as the silence between the notes makes the music, the ability of a portfolio manager to stay put, when necessary, is likely to determine the success of dynamic risk management over the long run.

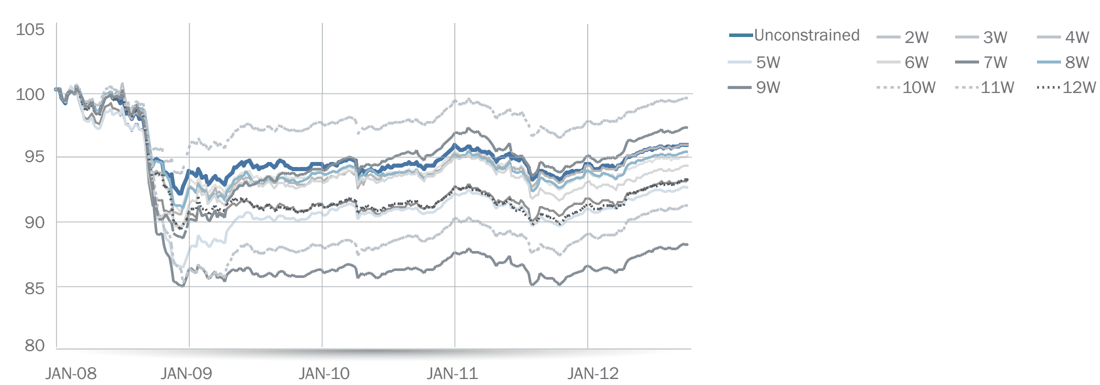
EXHIBIT 3

Impact of Portfolio Turnover

Source: Darolles and Vaissié (2014)

EXHIBIT 4

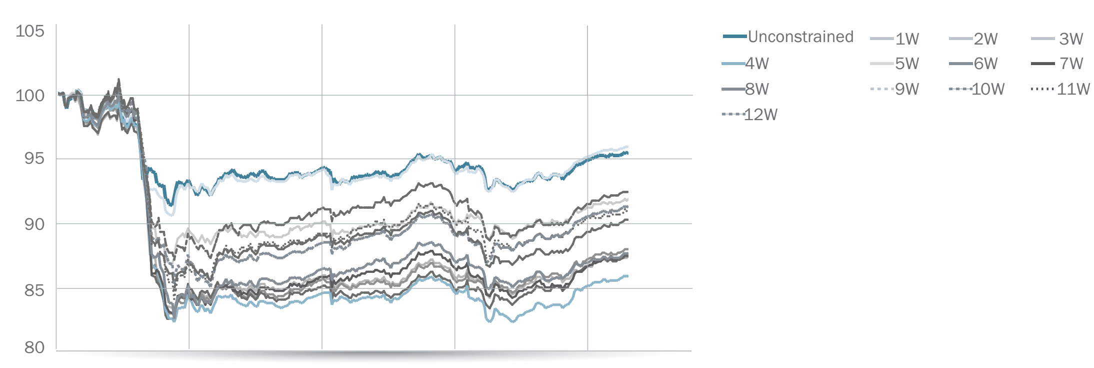
Impact of Rebalancing Frequency



Source: Darolles and Vaissié (2014)

EXHIBIT 5

Impact of Time-to-Market



Source: Darolles and Vaissié (2014)

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INDEXES

Should Commodities Be Included in Investment Portfolios?

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Commodities have recently attracted significant interest from the investment community.[14] Proponents of commodity investing stress the low correlation between commodities and traditional investments like equities and bonds and the diversification benefits from including commodities in portfolios. Commodities are also regarded as good hedges against expected and unexpected inflation. Tests of these conjectures can be found in papers by Bodie and Rosansky (1980) and Gorton and Rouwenhorst (2006).

The benefits of including commodities in multi-asset portfolios have, however, been questioned in a number of recent academic papers (Tang and Xiong, 2012; Büyükşahin, Haigh and Robe, 2010; Silvennoinen and Thorp, 2013; Lombardi and Ravazzolo, 2013). These papers argue that increased investment in commodities has made the correlation closer between commodities and traditional asset classes and, as a result, has reduced the diversification benefits associated with commodity investing. Daskalaki and Skiadopoulos (2011) find that the diversification benefits from commodities investing documented in previous studies do not survive tests out of sample. In this article we contribute to the debate on the benefits of commodities investing and extend current research by examining empirically the benefits from including commodities in the portfolio of a) an investor with and without liabilities, (b) one who believes that asset returns including commodities are time-varying and predictable, and (c) one that has a short or alternatively longer term horizon. Our object is to provide a condensed primer on the role of commodities in investment management to single and multiple horizon investors with and without liabilities.

We also consider a broad range of commodity investments. We start our analysis with the standard benchmark for commodity investments to date, the S&P Goldman Sachs Commodity Index (S&P GSCI). The S&P GSCI is a buy-and-hold world production-based index with a strong weight in the energy sector (approximately 70%). It is also one of the largest, by market share, commodity indexes and can be traded with over-the-counter swap agreements, exchange-traded funds (ETF) and exchange-traded notes (ETN) (Tang and Xiong, 2012). On the other hand, a growing literature (Ang, Goetzmann and Schaefer, 2010; Bender, et al., 2010; Ilmanen and Kizer, 2012; Blitz, 2012) suggests that investors can achieve more effective portfolio diversification by looking beyond asset class to factor-based allocation. We thus consider commodity portfolios based on momentum and the basis as part of the allocation universe. Last, we consider an uninformed equal-weighting scheme as in DeMiguel, Garlappi and Uppal (2009), which, according to Plyakha, Uppal and Vilkov (2012) harvests a number of systematic risk premia in the equity space.

Commodity investment return attributes

To gain insight into the potential benefits of including commodities in a multi-asset portfolio we explore the characteristics of commodity investment returns as a constituent of a multi-asset investment universe. We use a standard econometric specification for modeling the joint dynamics of

EXHIBIT 1

Term Structure of Risk of Commodities

Exhibit 1 presents the term structure of volatility of commodities for an investment horizon of 300 months (25 years). For commodities we consider (i) S&P Goldman Sachs Commodity Index (S&P GSCI), (ii) equally weighted portfolio monthly rebalanced (EW-CMI), (iii) long-only high momentum (H-M) and (iv) long-only high basis (H-B).

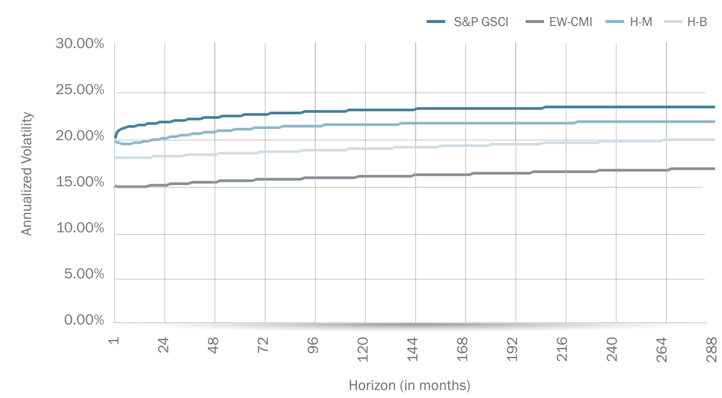
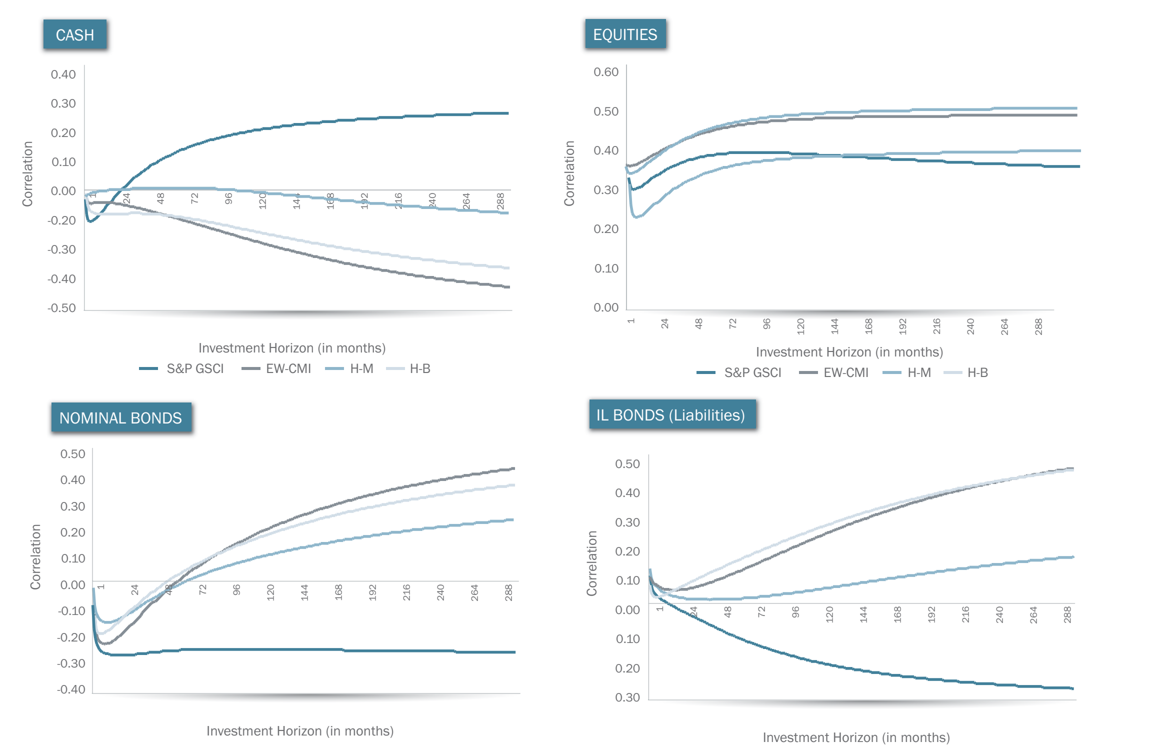


EXHIBIT 2

Term Structure of Risk of Commodities

Exhibit 2 presents the term structure of correlation of commodity premia with cash, stocks, nominal and inflation-linked (IL) bonds for an investment horizon of 300 months (25 years). For commodities we consider (i) S&P Goldman Sachs Commodity Index (S&P GSCI), (ii) equally weighted portfolio monthly rebalanced (EW-CMI), (iii) long-only high momentum (H-M) and (iv) long-only high basis (H-B).

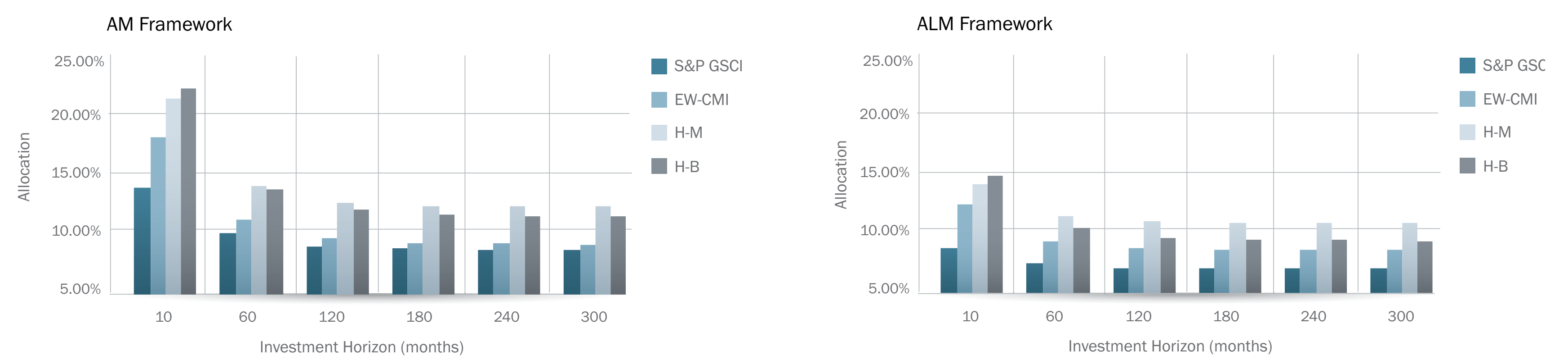


[14] *The total net assets of commodity exchange traded funds grew from US$ 1bn in 2004 to about US$ 120bn in 2011, according to data compiled by the Investment Company Institute. In addition, commodity assets are currently a non-negligible component of institutional investors' portfolios. The Global Alternatives Survey 2012 by Towers Watson and the Financial Times indicates that commodities represent roughly 2% of institutional investors' alternatives portfolio. Commodities constitute 2.2% of pension funds' alternatives portfolio and 4.7% of endowments' and foundations'. Stoll and Whaley (2010) report that in 2009 in the U.S. about 24% of commodity index investors are index funds, 42% institutional traders, 9% sovereign wealth funds, and 25% retail investors holding exchange-traded commodity index products.*

EXHIBIT 3

Allocation for Commodities

Exhibit presents the allocation to commodities for an average *(γ = 5)* dynamic asset-only (AM) and an asset-liability (ALM) investor. For commodities we consider (i) S&P Goldman Sachs Commodity Index (S&P GSCI), (ii) equally-weighted portfolio rebalanced monthly (EW-CMI), (iii) long-only high momentum (H-M) and (iv) long-only high basis (H-B). The 1-month horizon corresponds to the myopic investor; *γ* denotes the investor's coefficient of relative risk aversion.



asset returns, a VAR (1) specification as in Campbell and Viceira (2002). This framework allows us to estimate the conditional term structure of volatilities and, hence, study the time diversification properties of commodity portfolios. It also allows us to estimate the term structure of correlations of asset returns and study their risk diversification and liability risk hedging properties. These aspects of commodity investments are studied for investment horizons that extend to up to 25 years.

Exhibit 1 presents the term structure of risk of the commodity portfolios we consider for an investment horizon of 25 years (300 months). The evidence in Exhibit 1 suggests that these portfolios exhibit similar risk structure both in the short and long term. Hoevenaars, et al. (2008) also find that the volatility of commodities remains stable across investment horizons. We show that this observation extends to alternate commodity portfolios. With respect to the different portfolios we consider, we observe that the S&P GSCI is the most volatile at all investment horizons. Its volatility increases from 19.5% in the first month to 24.5% a year after 25 years. Of the other portfolios, momentum exhibits the highest volatility at all investment horizons, reaching 23% after 25 years. Interestingly, all commodity factor portfolios exhibit lower volatility than the buy-and-hold S&P GSCI portfolio at all investment horizons. We expect that this attribute of commodity factor portfolio returns plays an important role in the added value of commodity allocations for multi-period investors.

In Exhibit 2 we present the term structure of correlation between the commodity portfolios and the traditional assets that make up the investment universe. As in Exhibit 1 our analysis involves investment horizons of up to 25 years (300 months). A number of interesting insights emerge from this analysis. First, we note a fairly similar pattern in correlations with equities: there is an increase in correlation with investment horizon for up to about 7 years and rather stable correlations thereafter. For investment horizons of up to about 15 years, however, the basis portfolio exhibits the lowest correlation (the highest potential for risk diversification) with equities, whereas for longer investment horizons the GSCI shows the lowest correlation. Second, the S&P GSCI exhibits the lowest correlation with nominal bonds at all investment horizons.

We infer the potential of the alternate commodity portfolios in liability risk hedging through their correlation with inflation-indexed bonds. High correlation would suggest a potentially effective liability risk–hedging instrument. It appears that all active commodity portfolios exhibit positive correlation with inflation-indexed bonds at all investment horizons. The correlation is higher for longer investment horizons. In sharp contrast, the buy-and-hold S&P GSCI portfolio exhibits negative correlation with inflation-indexed bonds that becomes more negative at longer horizons. For long-term investors, only commodity factor portfolios provide a hedge for real liabilities.

Collectively our analysis indicates that the S&P GSCI-based commodity portfolios provide more diversification benefits than commodity factor portfolios when combined with nominal bonds, and they are almost as good as commodity factor portfolios when they are combined with equities, but they are bad hedges against real liabilities.

Is there really a case for a commodity allocation and in what form?

What are the implications from the diversification benefits and potential liability hedging properties of commodity portfolios for the optimal weight allocation of commodities in a multi-asset portfolio for an investor with a long-term horizon and liabilities? We use a recently developed analytical model to derive optimal allocations for investors, maximizing the utility of their assets over varying lengths of time (see Jurek and Viceira, 2011). We extend this model to address the investment decision problem of an investor with liabilities in her objective function (see Giamouridis, Sakkas and Tessaromatis, 2013). We denote the former investor as AM and the latter as ALM. We conduct analysis both in and out-of-sample.

In-sample analysis

Exhibit 3 illustrates the optimal allocation to commodity portfolios for AM and ALM investors with moderate risk aversion. The optimal weights for all commodity portfolios considered suggest a significantly higher allocation to commodities than current practice. As the graph shows, the allocation to commodities is higher for shorter investment horizons. This is consistent with the earlier finding that volatility of commodity portfolios and correlations with other assets in the investment universe are lower for shorter investment horizons. We also observe that commodity factor portfolios attract higher allocations than portfolios based on the S&P GSCI.

We quantify the economic benefits of including commodities in a portfolio by calculating the management fee[15] an investor would be prepared to pay to swap her investment strategy that did not involve commodity allocations for one that can potentially allocate to commodities. An AM investor with moderate risk aversion would be prepared to pay a management fee in the range of 2.64% to 3.16% a year, depending on the investment horizon (the higher fee is paid for shorter horizons), to gain access to the S&P GSCI-based commodity portfolio. She would also be prepared to pay a management fee of between 2.76% and 5.40% to gain access to commodity factor-based investments as part of her overall diversified portfolio. Similarly, an ALM investor should be willing to pay management fees in the range of 2.80% to 3.32% and 2.93% to 5.04% to gain access to the S&P GSCI and the commodity factor portfolios, respectively.

Out-of-sample analysis: the ultimate test

It is now well accepted in both academia and practice that in-sample evidence overstates the benefits of optimization-based investment strategies (DeMiguel, Garlappi and Uppal,

[15] *The management fee can be interpreted as the excess performance that would need to be generated by cash, stocks, nominal and inflation-indexed bonds to compensate for the absence of commodities (see Jurek and Viceira, 2011).*

2009). Out-of-sample–based tests should provide an unbiased assessment of the in-sample evidence and conclusions presented earlier. To generate the out-of-sample evidence, the asset return forecasts and asset portfolio weights depend on information available at the time. We again calculate the management fee and draw inferences accordingly.

Exhibit 4 shows management fees for AM and ALM investors and for different forms of commodity investments. The evidence in Panel A suggests that for AM investors who rebalance their portfolios monthly, the inclusion of S&P GSCI allocations has a negative effect. Daskalaki and Skiadopoulos (2011) also document negligible out-of-sample benefits when standard commodities like S&P GSCI are included in a traditional static portfolio. We show for the first time that this result extends to the short-term ALM investor, but also to the AM and ALM investors with longer investment horizons. The negative management fee ranges from -0.29% to -0.95% a year, a figure that is sizable and economically significant.

The most interesting result in our analysis is that allocations to commodity factor portfolios offer significant out-of-sample economic benefits. The management fee that moderate risk aversion, myopic AM and ALM investors would pay to have access to commodity factor-based portfolios is sizeable. For example, including a high basis commodity portfolio adds 0.66% a year to a traditional ALM portfolio and 1.18% to a traditional AM portfolio. In a dynamic asset allocation framework, AM and ALM investors would pay an annualized management fee of 1.13% and 0.72%, respectively, to have access to the high basis commodity portfolio, and 1.06% and 0.69% to incorporate the high momentum commodity portfolio in their asset mix. These findings support Rallis, Miffre and Fuertes (2013), who argue that active trading commodity strategies rather than standard commodity indexes provide more useful instruments for tactical and strategic asset allocation purposes.

Overall, the results suggest that optimal allocation to commodity investments can be economically beneficial only if it is in the form of commodity factor or equally-weighted commodity portfolios. In results we do not report here, we document that the economic benefits remain sizeable even after we account for reasonable transaction costs. Buy-and-hold commodity portfolios appear to destroy value in the context of diversified portfolios in our sample.

CONCLUSION

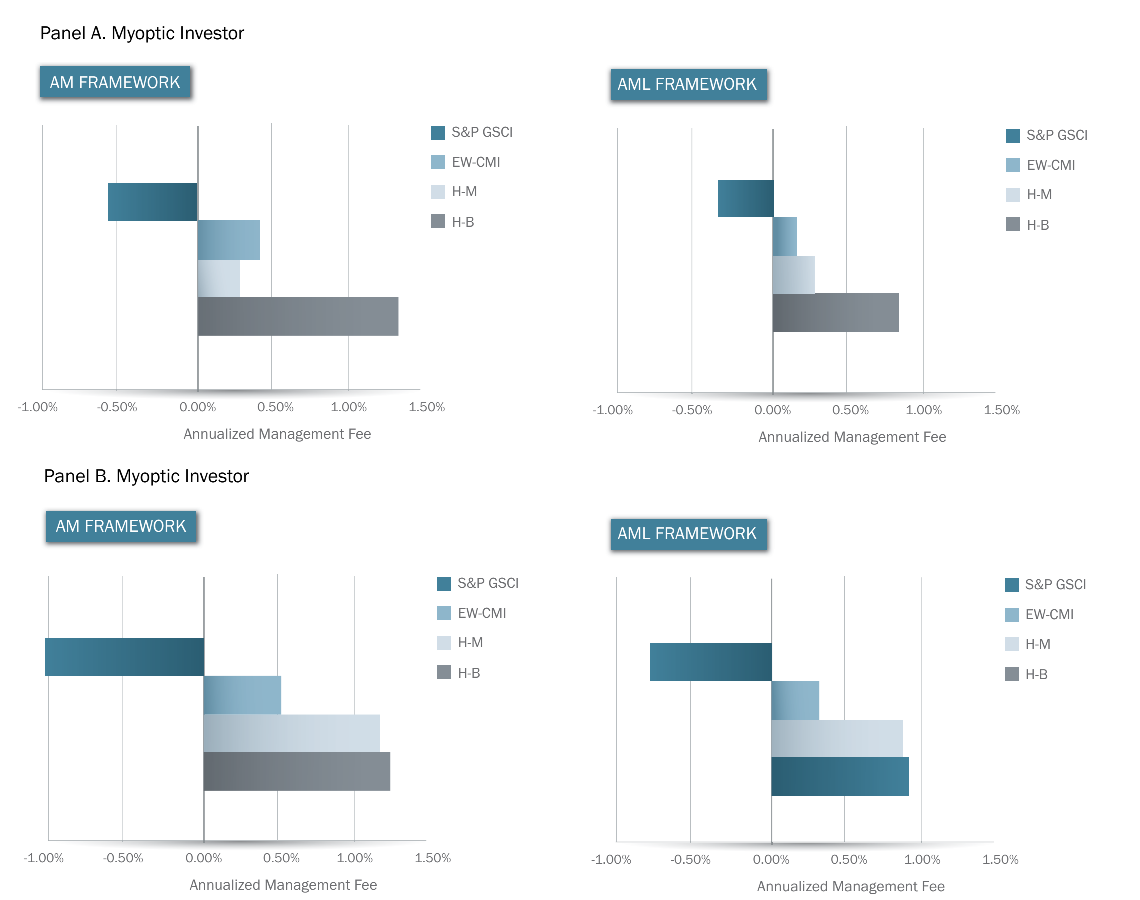
The role of commodities in investors' portfolios has recently been challenged by academic papers suggesting that the increased interest and investment in commodities has considerably reduced the diversification properties uncovered in earlier studies. More damaging for the case of including commodities in investor portfolios are findings based on out-of-sample tests that suggest that the in-sample economic benefits found in previous studies exaggerate the diversification benefits attributed to commodities. We also use out-of-sample–based tests, but in a much richer setting, to examine whether including commodities in portfolios is beneficial: investors with and without liabilities, investors with short and long horizons and asset return predictability. More importantly, we examine the benefits of equally weighted and high momentum and basis portfolios. Our evidence suggests a clear role for commodity factor portfolios but not the commonly used S&P GSCI-based commodity portfolios.

Future research should explain why standard commodity benchmarks fail to provide meaningful economic benefits to investors while factor-based commodity portfolios do. Perhaps commodity factor-based portfolios harvest certain risk premia that are not present in passive portfolios. Alternatively, it could be that the performance of standard benchmarks is heavily influenced by their significant over-exposure to oil. In this case, an answer to the more general question of what is an appropriate commodity investment benchmark should be sought. We leave these questions open for future research.

EXHIBIT 4

Annualized Management Fee

Exhibit 4 presents the annualized management fee an asset-only (AM) and asset-liability (ALM) average investor would pay to switch from a traditional portfolio (cash, stocks, nominal and inflation-indexed bonds) to a portfolio that also contains commodities. The investment horizon for the multiperiod investor is 5 years; denotes the investor's coefficient of relative risk aversion.



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INDEXES

The Performance of Idiosyncratic Volatility Strategies in Commodity Markets

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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 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.

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. Which risk factors are significant 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 U.S. 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.

The second set of risk factors is based on the theory of storage (Kaldor, 1939; Fama and French, 1987) and the hedging pressure hypothesis (Cootner, 1960) and is designed to identify commodity fundamentals relating to backwardation and contango. Backwardation means that futures prices are expected to rise as maturity approaches. It is signaled by downward-sloping term structures (positive roll yields), net short hedgers, net long speculators and good past performance (backwardated commodities are momentum winners).[16] The concept is illustrated in Exhibit 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 include the fundamentals of backwardation and contango. Using a cross-section of 27 commodity futures[17], the term structure portfolio buys the 20% of contracts that have 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. The ranking period over which the three signals are averaged is 12 months, and the holding period is 1 month. The constituents of the long–short portfolios are equally weighted with end-of-month rebalancing and the portfolios are fully collateralized. The dataset spans the period from January 1989 to December 2013; the frequency of the data is daily.

EXHIBIT 1

Historical crude-oil futures prices

The exhibit plots monthly futures prices of crude oil alongside shaded areas that 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).

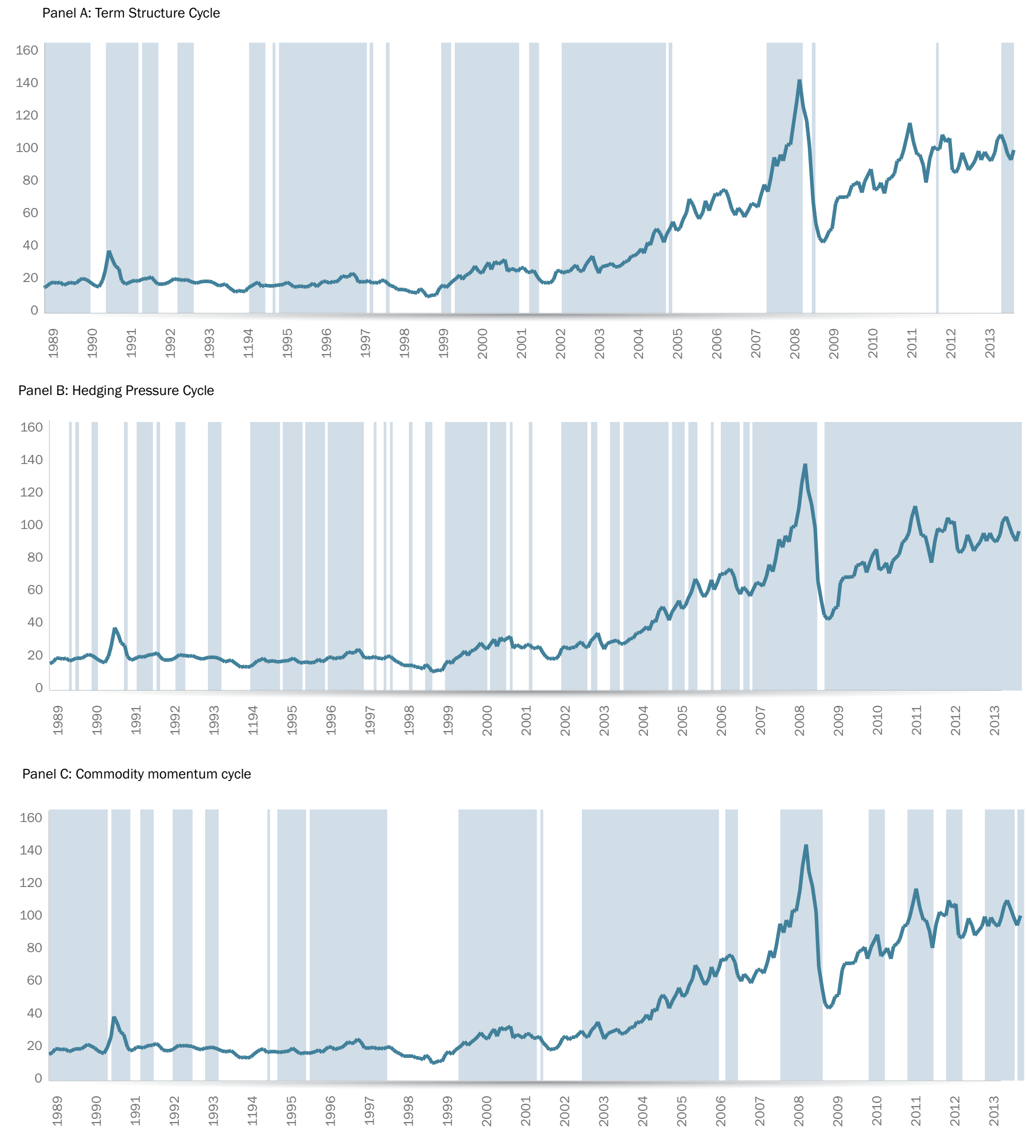

Table 1 summarizes the performance of the various risk factors. Panel A focuses on the factors originating from the traditional asset pricing literature and Panel B on the long–short commodity risk factors. The Sharpe ratios of the long–short commodity portfolios range from 0.41 to 0.51, with an average at 0.46, whereas that of the S&P-GSCI 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.

Performance of idiosyncratic volatility strategies

Our methodology closely follows that of Ang, *et al.* (2009) in their analysis of the relation between idiosyncratic volatility (*IVol* hereafter) and future equity returns. At the time

[16] 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).
[17] We use 12 agricultural commodities (cocoa, coffee C, corn, cotton n°2, frozen concentrated orange juice, oats, rough rice, soybean meal, soybean oil, soybeans, sugar n° 11, wheat), 5 energy commodities (electricity, gasoline, heating oil n° 2, light sweet crude oil, natural gas), 4 livestock commodities (feeder cattle, frozen pork bellies, lean hogs, live cattle), 5 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.

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 (ranking period R) spanning 1, 3, 6 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 collateralized, rebalanced at the end of each month, and based on equal weights for the constituents of the top and bottom quintiles. Table 2 summarizes the performance of *IVol* strategies designed using 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 using 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 that use 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 included in 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 Table 2) 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 with 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.

CONCLUSION

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 annualized 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 include 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 are the product 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.

TABLE 1

Summary statistics for risk factors

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 January 3, 1989 to December 31, 2013. Conventional significance t-ratios are reported in parentheses. Sharpe ratios are annualized mean excess returns (Mean) divided by annualized standard deviations (StDev).

	Mean		StDev	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

TABLE 2

Summary performance of idiosyncratic volatility mimicking portfolios

The table reports annualized mean excess return (Mean), standard deviation (StDev), 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. The 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.

	Mean		StDev	Sharpe Ratio	Alpha	
Panel A: Traditional risk factors						
S&P-GSCI						
R=1	0.0432	(1.99)	0.1062	0.4069	0.0429	(2.01)
R=3	0.0388	(1.80)	0.1053	0.3684	0.0385	(1.78)
R=6	0.0365	(1.68)	0.1057	0.3453	0.0361	(1.67)
R=12	0.0440	(2.02)	0.1064	0.4133	0.0435	(2.05)
Average	0.0406		0.1059	0.3835	0.0402	
S&P-GSCI, equity and bond indices						
R=1	0.0404	(1.87)	0.1057	0.3823	0.0372	(1.76)
R=3	0.0369	(1.70)	0.1057	0.3495	0.0344	(1.58)
R=6	0.0420	(1.92)	0.1059	0.3965	0.0413	(1.90)
R=12	0.0398	(1.78)	0.1069	0.3722	0.0395	(1.81)
Average	0.0398		0.1060	0.3751	0.0381	
S&P-GSCI, equity and bond indices, SMB and HML						
R=1	0.0425	(1.96)	0.1057	0.4021	0.0402	(1.86)
R=3	0.0404	(1.87)	0.1054	0.3838	0.0389	(1.79)
R=6	0.0405	(1.84)	0.1064	0.3803	0.0405	(1.84)
R=12	0.0399	(1.79)	0.1071	0.3731	0.0403	(1.84)
Average	0.0408		0.1062	0.3848	0.0400	
S&P-GSCI, equity and bond indices, SMB, HML, equity momentum						
R=1	0.0278	(1.29)	0.1053	0.2640	0.0258	(1.21)
R=3	0.0358	(1.64)	0.1062	0.3372	0.0358	(1.64)
R=6	0.0400	(1.82)	0.1066	0.3754	0.0412	(1.86)
R=12	0.0395	(1.77)	0.1071	0.3689	0.0417	(1.90)
Average	0.0358		0.1063	0.3364	0.0362	
Panel C: Comparison of average performance across benchmarks						
	0.0393	(2.00)	0.1061	0.3699	0.038	

	Mean		StDev	Sharpe Ratio	Alpha	
Panel B: Fundamental (long-short commodity) risk factors						
Term structure						
R=1	0.0258	(1.13)	0.1108	0.2325	0.0259	(1.12)
R=3	0.0093	(0.42)	0.1095	0.0851	0.0087	(0.38)
R=6	0.0054	(0.24)	0.1073	0.0499	0.0051	(0.23)
R=12	0.0048	(0.22)	0.1065	0.0447	0.0052	(0.24)
Average	0.0113		0.1085	0.1031	0.0112	
Hedging pressure						
R=1	0.0270	(1.22)	0.1078	0.2503	0.0202	(0.92)
R=3	0.0089	(0.39)	0.1119	0.0798	0.0006	(0.03)
R=6	0.0182	(0.80)	0.1106	0.1642	0.0104	(0.46)
R=12	0.0075	(0.33)	0.1109	0.0679	-0.0007	(-0.03)
Average	0.0154		0.1103	0.1405	0.0076	
Commodity momentum						
R=1	0.0131	(0.62)	0.1028	0.1271	0.0159	(0.76)
R=3	0.0038	(0.17)	0.1060	0.0356	0.0065	(0.29)
R=6	0.0012	(0.06)	0.1040	0.0115	0.0051	(0.23)
R=12	-0.0013	(-0.06)	0.1014	0.0130	0.0007	(0.03)
Average	0.0042		0.1036	0.0403	0.0070	
Term structure, hedging pressure and commodity momentum						
R=1	0.0226	(1.13)	0.0977	0.2309	0.0196	(0.98)
R=3	0.0202	(0.99)	0.0991	0.2036	0.0165	(0.80)
R=6	0.0172	(0.84)	0.0998	0.1719	0.0139	(0.65)
R=12	0.0117	(0.56)	0.1017	0.1150	0.0063	(0.30)
Average	0.0179		0.0996	0.1803	0.0141	
(Panel C)	0.0122	(0.64)	0.1055	0.1161	0.0100	

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INDEXES

The Importance of the Structural Shape of Crude-Oil Futures Curves

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Structural shape of crude-oil futures curves

In the past, one could confidently discuss how crude-oil futures contracts typically trade in backwardation. Backwardation means that a near-month futures contract trades at a premium to deferred-delivery futures contracts. For example, Litzenberger and Rabinowitz (1995) pointed out that the NYMEX West Texas Intermediate (WTI) crude-oil futures contract's front-to-back futures spreads were backwardated at least 70% of the time between February 1984 and April 1992. This pattern was so persistent that these authors wondered why this should be the typical shape of the crude-oil futures price curve.

This structural feature of the crude-oil futures market persisted for another 11 years. Goldman Sachs (2003) reported that from March 1983 through February 2003, the WTI futures contract had "been in backwardation 62% of the time, delivering an average yield of 0.78% per month."

Because of the persistence of backwardation in the crude-oil futures market, practitioners could come up with the concept of a positive roll yield, which is earned from continuously buying and rolling crude-oil futures contracts. The idea is that even if the front-month price of a crude-oil futures contract is stable, there can be a positive return, since the investor is continuously buying deferred futures contracts at a discount compared to where they eventually converge, resulting in an accumulating roll yield.

Roll yields in performance attribution

Further, Anson (1998) shows that from 1985 through 1997, roll yields accounted for essentially all of the futures-only returns in an investment indexed to the petroleum-complex–heavy (S&P) Goldman Sachs Commodity Index. Anson's article showed how the total returns of a collateralized commodity futures program can be ascribed to (1) spot return, (2) roll yield, and (3) the T-bill return. The spot return and the roll yield account for the futures only return of the program. Once the T-bill return is included from fully collateralizing the program, the total return of such a program can be calculated. We should emphasize that both the spot return and the roll yield are products of this particular method of performance attribution. In a futures program, one cannot directly receive the spot return separate from the roll yield; correspondingly, one cannot directly receive the roll yield separate from the spot return. Again, though, the advantage of this type of performance attribution is that it makes clear that buying and rolling a structurally backwardated commodity futures contract can have positive returns, even when its spot price is stable (or mean reverts).

Rolling a futures contract does not actually generate returns

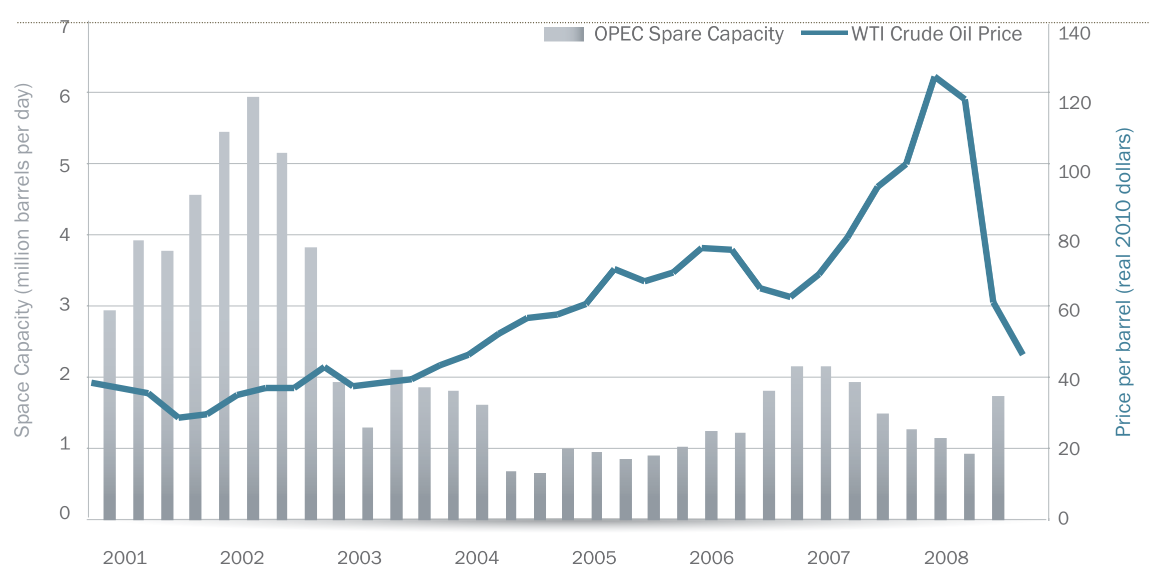
Now, both practitioners and academics have recently pointed out that one needs to be very careful in defining commodity futures roll yields. The act of rolling from one contract to the next does not in itself generate returns, just as selling Ford stock to buy GM stock does not in itself generate returns, as explained by Sanders and Irwin (2012). Instead, roll yields are a product of one type of performance attribution, as discussed above.

EXHIBIT 1

OPEC spare production capacity and WTI crude-oil prices

U.S. Energy Information Administration (EIA): "The extent to which OPEC member countries utilise their available production capacity is often used as an indicator of the tightness of global oil markets … EIA defines spare capacity as the volume of production that can be brought on within 30 days and sustained for at least 90 days. … OPEC spare capacity provides an indicator of the world oil market's ability to respond to potential crises that reduce oil supplies."

Graph is excerpted from EIA (2014), Slide 12.



The commodity futures curve's shape can be predictive of futures returns

That said, there is comfort in the peer-reviewed literature with treating a commodity futures contract's curve shape as of future returns. For example, among the research covering this topic, Gorton, Hayashi, and Rouwenhorst (2013) examine 31 commodity futures over the period 1971 to 2010. They find that "a portfolio that selects commodities with a relatively high basis… significantly outperforms a portfolio with a low basis…" The authors define basis as "the difference between the current spot price and the contemporaneous futures price." In other words, the winning portfolios contain futures contracts that are relatively more backwardated than the losing portfolios. The authors provide a fundamental rationale for their results, linking relatively high-basis futures contracts with relatively low inventories (and correspondingly, relatively more scarcity).

2004's structural break in the oil futures markets

Prior to 2004, if there were scarcity in the crude-oil markets, one could expect two outcomes, (1) increasing spot prices and (2) for the front-month price to trade at an ever larger premium to deferred-delivery contracts. Reflecting this relationship, there had been a +52% correlation between the level of outright crude prices and the level of front-to-back–month calendar spreads from December 1986 through December 2003.

As discussed at the beginning, when the front-month price trades at a premium to the deferred-delivery contracts, this is known as backwardation. When a futures curve instead trades in contango, the front-month price trades at a discount to the deferred-delivery contract. In times of surplus, inventory holders receive a return to storage, as represented by the size of the contango, since they can buy the crude oil immediately at a lower price and lock in positive returns to storage by simultaneously selling the higher-priced contract for a future delivery. If inventories breach primary storage capacity, the crude curve will trade in deeper contango, so as to provide a return for placing the commodity in more expensive, secondary storage (and eventually, tertiary storage.)

The WTI crude curve's structural relationship changed from 2004 to the summer of 2007. During that period, the level of crude-oil prices became -75% correlated with its corresponding calendar spread.

Through the summer of 2007, the structural rigidities in the crude-oil market translated into large contangos and high flat prices. What changed during 2004? See Exhibit 1. During mid 2004, OPEC's immediately-deliverable spare capacity collapsed. The International Monetary Fund later explained in 2005 that this occurred because of "synchronised global growth, high oil demand (especially from China), and a series of supply disruptions…"

Why does this matter?

As explained in Harrington (2005), the true inventories for crude oil should be represented as above-ground stocks plus excess capacity. Historically, the markets had been able to tolerate relatively low oil inventories because there was sufficient swing capacity that could be brought on stream relatively quickly in the case of any supply disruption.

During 2004, however, the oil market's excess supply cushion dropped to sufficiently low levels that there were two resulting market responses, (1) there were continuously high spot prices to encourage consumer conservation and (2) the market undertook precautionary stock building, which arguably led to the persistent (but not continuous) contangos that the crude-oil market began experiencing in late 2004.

By July 2008 the excess-capacity cushion became exceptionally small relative to the risk of supply disruptions owing to naturally-occurring weather events as well as to well-telegraphed and perhaps well-rehearsed geopolitical confrontations. At that point, the role of the spot price of oil was arguably to find a level that would bring about sufficient demand destruction to increase spare capacity; this did occur quite dramatically, starting in the summer of 2008, after which the spot price of oil spectacularly dropped by about $100 per barrel by the end of 2008.

Possible return in importance of roll yields

Could the world be in a situation where fears of worryingly low OPEC spare capacity are diminishing? There is definitely not universal agreement on this topic but at least according to the International Energy Agency (IEA), "OPEC's spare crude oil production capacity will surge 25 percent in the next two years as rising U.S. shale output crimps demand for the group's supplies," reported Nguyen (2013) in Bloomberg News.

If OPEC spare capacity were not in question, then there would not be a need for precautionary stock building and relatively low oil inventories would be tolerable. Typically when there have been low crude oil inventories, the oil-futures curve has been backwardated, leading to positive roll yields.

The above analysis applies to any oil futures contract that is seamlessly connected to the global oil markets. This is because we are using a measure of global oil market tightness, OPEC spare capacity, as a plausible explanatory variable for whether one can expect positive roll yields. As noted in Blas (2011) in a Financial Times article, "From time to time, the [WTI] contract has disconnected from the global oil market due to logistical troubles at its landlocked point of delivery in Cushing, Oklahoma." The result has been a different curve shape and different returns from buying and holding Brent crude futures contracts versus WTI crude futures contracts. See Exhibit 2.

Nevertheless, Platts (2013) has noted that "many pieces of the logistical puzzle" in North America are now falling into place, thanks to the "ingenuity of logistical engineers," in managing the increase in U.S. domestic crude supplies. Further, in JP Morgan (2013), the bank's commodity analysts have written that "the boom in…domestic oil production has been well absorbed by existing U.S. infrastructure…Truck, rail, and barge have all served to move the large increase in domestic crude supplies to U.S. refineries," who, in turn, can export petroleum products abroad. This has been the mechanism for connecting the U.S. oil markets to global markets, since exporting crude oil itself is presently illegal, with some minor exceptions. To the extent that this logistical ingenuity continues, the importance of roll yields as an ongoing driver of returns for holding WTI oil futures contracts may be justified, just as it has for Brent oil futures contracts. Both the WTI and Brent oil curves are currently trading in backwardation.

Going forward: backwardation, swing capacity, and roll yield

It may be that a whole host of systematic futures strategies and indexes that exploit structural backwardation in the crude-oil futures may become fashionable again. For example, JP Morgan (2013) noted that among 65 commodity index products, two of the indexes, which emphasize backwardation, may have excellent prospects over the next two years. Furthermore, PIMCO's commodity portfolio managers noted in Johnson and Sharenow (2013) that "as long as Saudi Arabia maintains the ability to manage imbalances in the market and shale extraction prospects remain good, we expect the oil market roll yield to look similar to that in the 1990s…"

We may be returning to a Litzenberger-and-Rabinowitz state-of-the-world of structurally backwardated oil-futures curves. In that case, it may be useful to revisit research done in the 1990s on structural drivers of both oil-futures and commodity-index returns. ~

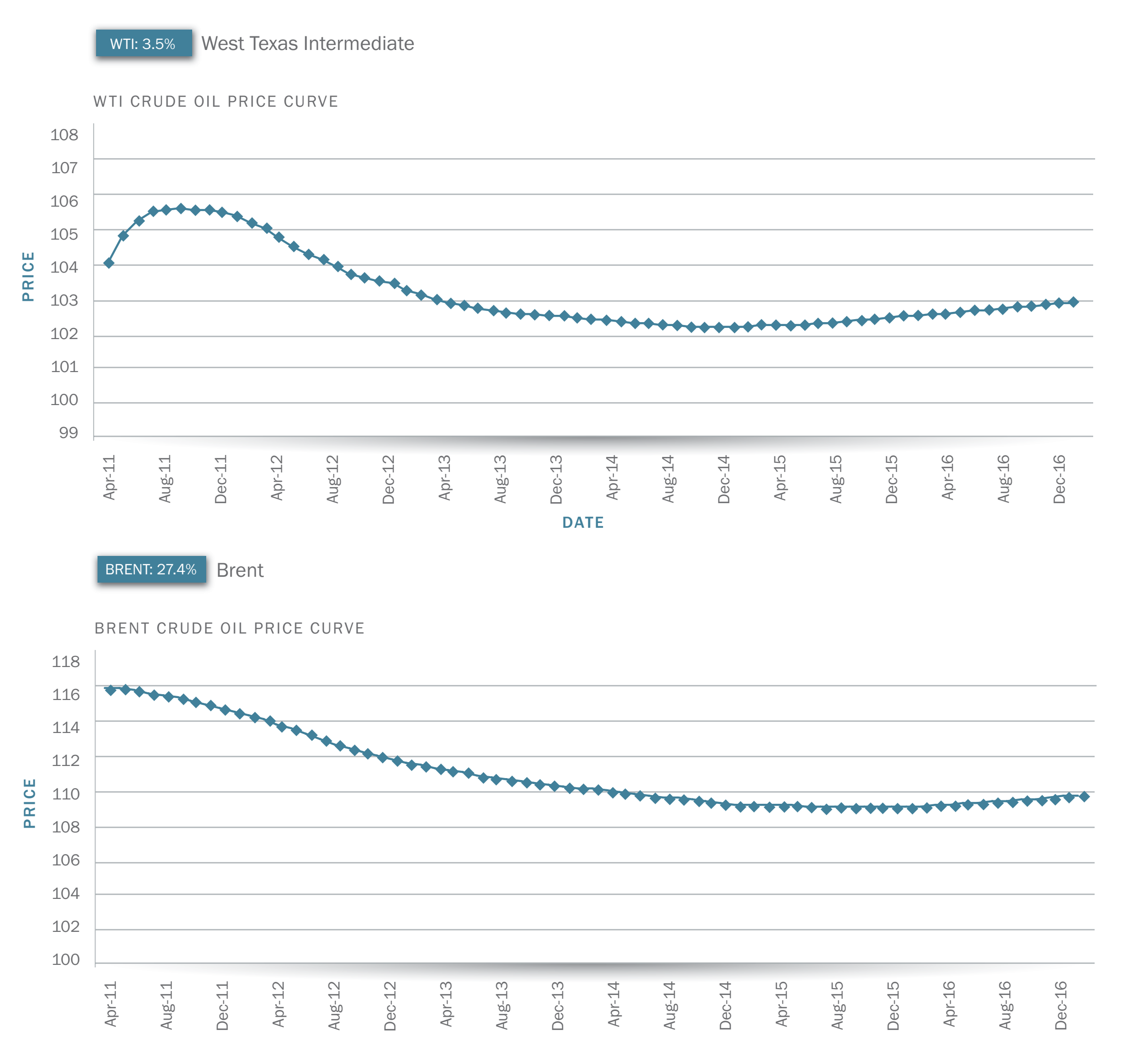
ENDNOTES

The author wishes to thank Candice Graham of the CME Group for support of the research that led to this paper. This research, in turn, was originally published in full as Till (2014).

The views expressed in this article are the personal opinions of Hilary Till and do not necessarily reflect the views of organizations with which Ms. Till is affiliated.

EXHIBIT 2

12/31/08 to 2/28/11 Annualized Excess Returns:



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