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# EDHEC-Risk Institute Research Insights

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EDHEC-RISK DAYS ASIA SPECIAL

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**EDHEC-RISK**  
Institute



# EDHEC-Risk Institute Research Insights

## Introduction Frédéric Ducoolombier

In 2004, EDHEC-Risk Institute introduced a new type of conference aiming to bring research insights to investment professionals. These events present the research done by EDHEC-Risk Institute and discuss it with the investment community. In 2012, the institute exported its conference concept to Asia in order to give Asia-based finance professionals easier access to state-of-the-art research in investment and risk management and to establish a dialogue around research results with particular relevance to investors and institutions in Asia. The inaugural conference attracted over 800 participants including end-investors, traditional and alternative investment managers, wealth managers, investment bankers, and policy-makers. Building on this success, the EDHEC-Risk Days Asia 2013 will be held on 15–16 May 2013. In order to mark this second staging of the conference, this Research Insights supplement devotes a large proportion of its content to Asian-based and Asia-relevant research.

In the first of the current articles, we look at the quality of Asian stock market indices, in research that we believe is the first to analyse the efficiency and stability of a set of popular equity Asian indices. Following on from similar research conducted by EDHEC-Risk on US and European data samples, the inefficiency of standard Asian equity indices shows that there is considerable room for improvement when constructing well-diversified portfolios.

We then look at the benefits of structured equity investment strategies for long-term Asian investors, drawing on research supported by Société Générale Corporate & Investment Banking (SG CIB). The results indicate that target volatility products can be attractive to investors for several reasons.

The subject of Asian volatility indices and volatility products is also examined by our Singapore-based researchers. Investors with Asian equity exposures may be willing to consider Asian volatility products for diversification, hedging, or speculative bets. At this stage, however, volatility futures are available only on the Hong Kong and Osaka stock exchanges, with limited liquidity.

The EDHEC-Risk Asian Index Survey, supported by Amundi ETF, which we present in the supplement, is the first comprehensive survey of Asian investment professionals to analyse the current uses of and opinions on stock and bond indices. The survey reveals that usage of indices is much higher in equities than in fixed-income asset classes amongst Asian investors and that, for portfolio construction in equities, Asian investors regard indices that allow a geographic approach (global, regional and country indices) as much more important than indices allowing for other segmentations.

As part of its strategic plan to develop research from Singapore on the subject, EDHEC Risk Insti-

tute-Asia has recently strengthened its capacity to undertake research on infrastructure investment. The article in this supplement, drawn from the recently-launched research chair on Investment and Governance Characteristics of Infrastructure Debt Instruments supported by Natixis, examines the role of construction risk in the design of efficient portfolios of infrastructure debt and concludes that such an efficient portfolio ought to include at least some construction risk, independently of investors' risk preferences.

The research from which the article on avoiding sovereign credit risk exposure in equity portfolios was drawn was presented for the first time at the EDHEC-Risk Days Asia 2012 conference. The strong presence of representatives from central banks and sovereign wealth funds ensured that the research was well received. The recent sovereign risk crisis in developed countries has reminded equity investors around the globe that, even when not directly holding government bonds, they may be heavily affected by a worsening of sovereign credit risk conditions. We seek to determine in our research whether it is possible to reliably categorise stocks by their exposure to sovereign risk in order to create equity portfolios with low sovereign risk exposure. The main finding is that our measurement of sovereign risk exposure of stocks is reliable out-of-sample: in bad times where negative news occurs on sovereign risk conditions, our low sovereign beta portfolios do indeed outperform high sovereign beta portfolios.

In a further article, we provide our response to the European Commission White Paper, An Agenda for Adequate, Safe and Sustainable Pensions. In this area, EDHEC-Risk Institute believes that pension systems should better take into account the needs of current and future retirees. This can only happen through deep structural changes moving the diverse systems towards more hybrid solutions.

Another important aspect of the same topic is improving risk management in defined contribution (DC) and hybrid pension plans, which is the subject of a separate article. There is a substantial need to improve investment and risk management strategies in DC and hybrid funds. One cannot go without the other, and the generalisation of modern asset-liability management practices is paramount to managing the investment risks.

We hope you will find all of these articles interesting and informative. We would again like to thank our partners at IPE, and particularly its editor, Liam Kennedy, for working with us to provide what we hope are valuable research insights for institutional investors around the world.

*Frédéric Ducoolombier, Director, EDHEC Risk Institute-Asia*

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# Assessing the quality of Asian stock market indices

Véronique Le Sourd, Senior Research Engineer, EDHEC-Risk Institute

A recent survey<sup>1</sup> of Asian investors conducted by EDHEC-Risk Institute underlines that indices are widely used in Asia, either when assessing the performance of active managers or when implementing passive strategies. Total exchange-traded fund assets increased by 20–30% annually post-2008 and the number of products has gone up by more than 200%. Currently total ETF assets in Asia-Pacific are estimated at approximately \$124bn. On a year-to-date basis, total assets have increased by 36% compared to last year's closing (Deutsche Bank [2012]). All of these factors point to increasing interest in indexed management and investing directly in tracking products for standard market indices in Asia. Meanwhile, it seems that relatively little analysis has been done to evaluate the quality of Asian indices. While many investigations have been carried out in recent years, both by practitioners and academics, questioning the efficiency, stability and representativity of cap-weighted indices (cf Haugen and Baker [1991]; Grinold [1992]; Amenc et al [2006]; Arnott et al [2005], among others), most of them were performed using US or European indices.

Therefore, EDHEC-Risk Institute recently conducted a detailed analysis of a set of popular equity Asian indices to evaluate the quality of these indices. This study is part of a global reflection undertaken by EDHEC in recent years on the efficiency of market indices in several parts of the world (Amenc et al [2006]), as well as on the relevance of using market-cap for weighting indices (Goltz and Le Sourd [2010]), and resulting in proposals to improve index efficiency (Amenc et al [2010]; Amenc et al [2011]).

The EDHEC study has selected the indices that are the most popular in terms of volume invested in related index products and analysed several indices for stock markets in Japan (Nikkei 225 and Topix 100), China (FTSE China 25 and CSI 300), Hong Kong (Hang Seng), South Korea (KOSPI 200), India (Nifty 50), Taiwan (FTSE TWSE 50), Singapore (FTSE Straits Times Index) and for the ASEAN region (FTSE ASEAN Index, which is built from stocks from Singapore, Malaysia, Thailand, Indonesia and Philippines). Most of these indices follow the standard cap-weighting scheme. Exceptions are to be found with the FTSE China 25 Index, which uses capping rules to limit the concentration in large-cap stocks and with the Nikkei index, which is price-weighted rather than cap-weighted. This study has examined whether the main issues with indices that have been outlined in the literature for North American and European stock market indices are also relevant for the major Asian market indices.

This study has especially considered the efficiency and stability of indices. Whether indices are used as benchmarks in performance measurement or as underlyings for investment products, an efficient risk/reward profile of such indices

## 1. Improvements in Sharpe ratio through equal-weighted, maximum Sharpe ratio and minimum variance indices compared to standard index

Market index	Time period	Market index Sharpe ratio	Difference in Sharpe ratio of EW portfolio and market index	Difference in Sharpe ratio of max Sharpe ratio portfolio and market index	Difference in Sharpe ratio of min variance portfolio and market index
Hang Seng	Jan 2002–Dec 2010	0.53	0.11	1.38	0.47
Nikkei 225*	Jan 1996–Dec 2010	–	–	–	–
Topix 100	Feb 1999–Dec 2010	0.05	0.25	1.62	0.23
FTSE STI	Sep 2001–Dec 2010	0.65	0.30	1.47	0.33
KOSPI 200	Jun 2001–Dec 2010	0.48	0.23	2.21	0.27
TWSE 50	Jan 2003–Dec 2010	0.51	0.10	1.54	0.31
CSI 300	Jan 2006–Dec 2010	0.83	0.51	1.79	0.64
FTSE China 25	Jan 2003–Dec 2010	0.73	0.15	1.08	–0.19
Nifty 50	Jan 2003–Dec 2010	0.82	0.25	1.64	0.40

\* The Sharpe ratios for the Nikkei are invalid due to the negative aggregate return over the period. A negative Sharpe ratio is not meaningful as increases in volatility would increase the Sharpe ratio when excess returns are negative. Therefore we prefer not to report the results for indices where the Sharpe ratio is negative.

is crucial to avoid using a poor starting point in the investment process (Amenc et al [2006]). Stability is also an essential quality of indices, as investors typically perceive a reference index to be a neutral choice of long-term risk factor exposures. However, some studies have suggested that the currently available market indices display unstable risk exposures over time (Amenc et al [2006], Goltz and Sahoo [2011]).

The efficiency test has consisted in analysing the risk-return efficiency of current Asian market indices. In addition, a concentration analysis of these indices was performed to see if index concentration may explain a lack of efficiency.

The efficiency of the standard Asian cap-weighted indices was evaluated by measuring the distance in terms of efficiency between a given Asian stock market index and its alternatives on a mean variance plane. Alternative portfolios were made of the same list of stocks with different weighting schemes, including equal-weighting, global minimum variance (GMV) and maximum Sharpe ratio (MSR) weighting; the GMV and MSR portfolios being two portfolios on the efficient frontier. It appears that the existing Asian stock market indices are highly inefficient compared to either in-sample mean variance optimisation or equal-weighting of the same stocks.

Table 1 shows the improvements in Sharpe ratio through an equal-weighted portfolio which is rebalanced daily, as well as for mean variance optimal portfolios (MSR and GMV) which are rebalanced annually. The results suggest that considerable improvements in terms of risk-reward efficiency (ie, Sharpe ratio) are achieved by the alternatively-weighted portfolios, except for the GMV weighted portfolio of FTSE China 25 stocks.

Overall, these results are comparable with earlier studies on major indices in developed markets (Amenc et al [2006]), which were found to be highly risk-return inefficient compared to in-sample optimal portfolios and even equal-weighted portfolios.

Cap-weighted indices are often blamed for

their concentration in a few large stocks, as shown by Tabner (2007) and Malevergne et al (2009) for developed markets. Thus, the same kinds of investigations were carried out on Asian indices.

Table 2 reports the comparison between the nominal number of stocks in each Asian index, on average over the time period studied, and the effective number of stocks held in the index, obtained as  $1/\sum_{i=1}^n w_i^2$ . This latter measure corresponds to the number of constituents in an equal-weighted portfolio that leads to the same concentration as the cap-weighted market index. The smaller the difference between the nominal number and the effective number, the less concentrated the index.

The results displayed in table 2 provide evidence that most market indices in Asia exhibit a small effective number of constituents compared to their nominal number of stocks and are thus highly concentrated. For all but two indices, the effective number of stocks held in the index is less than 50% of the actual number of stocks. The KOSPI 200 index appears to be the most concentrated index, with an effective number of stocks of 21 compared to the nominal number of 200 stocks, while the FTSE China 25 index appears to be the least concentrated index. This high index concentration leads to poor diversification, which causes indices to bear the risk of the few assets that have the largest capitalisation, instead of eliminating all idiosyncratic risk. While investors should expect risk reduction through index diversification, the index performance rather mirrors the performance of a few large-cap stocks in the indices, resulting in a poor risk-adjusted return performance. Indeed, if we compare the results obtained in table 1 and table 2, it appears that indices for which we observe the maximum difference in Sharpe ratio between the MSR portfolio and the cap-weighted portfolio, are also the ones exhibiting the highest concentration – ie, the lowest ratio of effective number of stocks to nominal number of stocks.

The stability of the exposures to sectors and styles of the major Asian indices were

1 Amenc N., F. Goltz, M. Mukai, P. Narasimhan and L. Tang (2012). EDHEC-Risk Asian Index Survey 2011. EDHEC-Risk Institute (May).

## 2. Concentration in standard indices

Index	Time period	Average nominal number of constituents	Average effective number of constituents	(Effective number of stocks)/ (Nominal number of stocks)	Weight concentration in top fifth of constituents
Hang Seng	Jan 2002–Dec 2010	45	11.7	29.3%	63.3%
Nikkei 225	Feb 2001–Dec 2010	225	82.6	36.7%	61.2%
Topix 100	Jan 2001–Dec 2010	100	49.0	49.0%	49.7%
FTSE STI	Feb 2008–Dec 2010	30	16.9	56.2%	50.3%
KOSPI 200	Feb 2002–Dec 2010	200	20.9	10.4%	80.0%
TWSE 50	Jul 2003–Dec 2010	50	20.6	41.2%	52.3%
CSI 300	Sep 2005–Dec 2010	300	91.1	30.3%	59.5%
FTSE China 25	Mar 2004–Dec 2010	25	18.6	74.4%	40.2%
Nifty 50	Feb 2002–Dec 2010	50	21.6	43.2%	56.7%
FTSE ASEAN	Jan 2001–Dec 2010	163	49.2	30.2%	63.3%

This table is the summary of the results from the concentration analysis. Column 4 represents the effective number of stocks which is calculated by the formula: Effective number of stocks =  $1/\sum_{i=1}^n w_i^2$ . In column 5 we calculate the ratio of Effective number of stocks/Number of constituents in the index.

also tested. Table 3 reports the drift scores (cf Idzorek and Bertsch [2004]) – defined as

$$D = \sqrt{\sum_{k=1}^n \sigma_k^2}$$

where  $\sigma_k^2$  denotes the variance of the time series – for both style and sector stability tests. The results show that all indices exhibit considerable variations in both sector and style exposures during the test period. Concerning sectors, it appears that market indices in more developed countries (Hong Kong, Japan, Singapore, South Korea and Taiwan) demonstrate relatively more stability, whereas market indices in less developed countries (China and India) display higher variability over time in terms of sector allocation. Such a clear pattern is not to be found for the style drift scores.

The variability of index exposures to styles and sectors appears to be quite a big issue for indices. Investors typically perceive market indices to be a neutral choice of long-term risk factor exposures. However, the results of the

study show that all indices exhibit considerable variability of exposures over time. Thus, an investor who passively holds an index, or chose a market index as benchmark, may see his risk exposure to styles and sectors modified through time, and no longer correspond to his initial asset allocation and risk choices. The assumed passive management is then turned into an implicit dynamic allocation to styles and sectors over time, causing a major implementation risk for investors confronted with new allocation choices that may deviate significantly from their initial choices.

To conclude, it appears from this study that the inefficiency of standard Asian equity indices relative to equal-weighted portfolios of the same stocks, or relative to in-sample optimal portfolios, shows that there is considerable room for improvement in principle when constructing well-diversified portfolios. It should be noted however, that such in-sample portfolios are not feasible investment alternatives as they abstract from the

problems faced in practice with reliable parameter estimation. However, this analysis suggests that in principle, there is a long distance to cover for the cap-weighted market indices before they would be efficient. The practical challenge will then be to exploit some of this room for improvement through practical weighting schemes. The lack of efficiency of the standard Asian indices is perhaps not surprising given that they exhibit high concentration in a small number of stocks. In fact, by overweighting the largest capitalisation stocks, these indices end up being exposed to stock-specific risk. Finally, the stability analysis shows that Asian indices suffer from pronounced fluctuations in their risk factor exposures, causing investors to be exposed to implicit choices on risk factor exposures when tracking a market index. Overall, Asian stock market indices are thus faced with similar problems to indices in Europe and North America which have been widely criticised in the literature. Our findings suggest that there are good reasons for investors to assess whether practical improvements over cap-weighted indices will be able to reduce these inefficiencies and instabilities when investing in Asian equity markets.

### References

- Amenc, N., F. Goltz, and V. Le Sourd (2006). *Assessing the Quality of Stock Market Indices: Requirements for Asset Allocation and Performance Measurement*. EDHEC-Risk Institute.
- Amenc, N., F. Goltz, L. Martellini, and P. Retkowsky (2010). *Efficient Indexation: An Alternative to Cap-Weighted Indices*. EDHEC-Risk Institute (January).
- Amenc, N., F. Goltz, L. Martellini, and S. Ye (2011). Improved Beta? A Comparison of Index-Weighting Schemes. *Journal of Indexes* (January/February).
- Arnott, R., J. Hsu, and P. Moore (2005). Fundamental Indexation. *Financial Analysts Journal* 60 (2): 83–99.
- Deutsche Bank ETF Research Asia. 20 October 2012.
- Goltz, F., and V. Le Sourd (2010). *Does Finance Theory Make the Case for Capitalisation-Weighted Indexing?* EDHEC-Risk Institute.
- Goltz, F., and D. Sahoo (2011). *What Drives the Performance of Efficient Indices?* EDHEC-Risk Institute (March).
- Grinold, R. (1992). Are Benchmark Portfolios Efficient? *Journal of Portfolio Management* 19 (1): 34–40.
- Haugen, R., and N. Baker (1991). The Efficient Market Inefficiency of Capitalization-Weighted Stock Portfolios. *Journal of Portfolio Management* 17 (3): 35–40.
- Idzorek, T. and F. Bertsch (2004). The Style Drift Score. *Journal of Portfolio Management* 31(1): 76–83.
- Malevergne, Y., P. Santa-Clara and D. Sornette (2009). Professor Zipf Goes to Wall Street. Working Paper Series, National Bureau of Economic Research.
- Tabner, I. (2007). Benchmark Concentration: Capitalization Weights versus Equal Weights in the FTSE 100 Index. Working paper. University of Stirling.

## 3. Summary of the sector/style stability of Asian indices

Geographical zone	Index	Sector stability test		Style stability test	
		Period	Style drift score	Period	Style drift score
Hong Kong	Hang Seng	Jan 2001–Dec 2010	8.89%	Jan 2002–Dec 2010	11.77%
Japan	Nikkei 225	Jan 2001–Dec 2010	4.83%	Jan 2002–Dec 2010	20.59%
	Topix 100	Jan 2001–Dec 2010	6.81%	Jan 2002–Dec 2010	12.79%
Singapore	FTSE Straits Times	Feb 2008–Dec 2010	4.399%	Jan 2002–Dec 2010	6.39%
South Korea	KOSPI 200	Feb 2002–Dec 2010	8.44%	Jan 2002–Dec 2010	8.48%
Taiwan	FTSE TWSE Taiwan 50	Jul 2003–Dec 2010	6.51%	Jan 2002–Dec 2010	5.80%
China	CSI 300	May 2005–Dec 2010	11.44%	Jan 2003–Dec 2010	8.96%
	FTSE China 25	May 2005–Dec 2010	11.11%	Mar 2002–Dec 2010	19.53%
India	Nifty	Jan 2002–Dec 2010	11.51%	Jan 2002–Dec 2010	6.64%
	ASEAN	FTSE ASEAN	Jan 2001–Dec 2010	5.02%	na

This table summarises the results from the style and sector stability tests. Columns 3 and 5 present the period of the results. Columns 4 and 6 present the style drift score based on Idzorek and Bertsch (2004) for both style and sector variations over the test periods.

# Structured equity investment strategies for long-term Asian investors

**Stoyan Stoyanov**, Head of Research, EDHEC Risk Institute–Asia, Professor of Finance, EDHEC Business School

Institutional investors face significant challenges currently because of two big factors – the macroeconomic and the regulatory environment. Regulation and accounting standards force them to invest in low risk assets that are highly correlated with liabilities. At the same time, they operate in a low interest rate environment where attractive risk premia are

offered by asset classes that exhibit typically low correlation with liabilities. A big challenge for long-term investors and especially for underfunded institutions is, therefore, how to extract risk premia and at the same time have a limited exposure to downside risks.

In recent years, it has become clear that structured investments could have a significant

role in addressing these challenges. Structured investment strategies are based on derivatives with a pay-off function and features tailored to investor needs. Although a wide variety of strategies exists, not fitting a single definition, usually they contain an asset and a derivative structure designed to provide a particular pay-off at maturity. Some popular structures allow investors to gain access to the upside potential of the distribution of the asset and at the same time provide protection on the downside. The results from Goltz, Martellini and Simsek (2008) imply that buy-and-hold investors

◀ should optimally allocate a sizable fraction of their portfolios to portfolio insurance strategies.

Hens and Rieger (2009) indicate that structured products are very popular in Germany and Switzerland and less so in the US. Although demand suffered as a result of the 2008 market crash, demand for structured products is again on the rise in Asia. The overall level of maturity of the markets in Asia and the heterogeneity of regulation across countries, however, create challenges in designing the derivative structure. The derivatives market that has been growing most rapidly, although non-uniformly across countries, is the equity derivatives market. As a result, structured equity investment products appear less costly to design on a relative basis and, because of the high expected growth of Asian economies, they are also attractive from the standpoint of institutional investors.

The main challenges are in the features of Asian equity markets that distinguish them from the European and the US markets – they are more volatile and, perhaps more importantly, volatility derivatives are difficult to get. The reason for this difficulty is that the equity derivatives market remains relatively immature despite its recent growth and derivatives based on option implied volatility indicators are not widely available, even when such indicators exist.

In recent research conducted with the support of Société Générale Corporate & Investment Banking (SG CIB), we explore the empirical characteristics of Asian equity markets and document significant departures from normality for all markets whether developed or emerging. This means that returns on Asian equity indices do not conform to a normal distribution with stable mean and volatility. We also find that volatility of Asian markets, excluding Australia and New Zealand, is higher than that of the developed markets in Europe and the US. Because the volatility of Asian equity markets is generally higher and volatility risk is difficult to hedge for Asian investors in the absence of volatility derivatives, it makes sense to consider structured equity investment strategies with a target volatility feature.

From a theoretical perspective, target volatility strategies can be rationalised in the framework of dynamic asset allocation models. Extending the framework developed by Merton (1969, 1971) with stochastic volatility leads to a fund separation theorem in which the component responsible for performance generation can be interpreted as a target volatility strategy. As a side result, dynamic asset allocation models imply that an efficient way to deal with the problem of extreme risk arising from stochastic volatility is to construct a portfolio with a constant volatility.

**I**n our research, we develop a formal comparative analysis of different strategies in a framework allowing for stochastic volatility reflecting the reality of Asian equity markets. To this end, we choose to model the economy through a stochastic volatility model known as Heston's model that can accommodate many of the observed departures from normality of the equity return distribution, most notably the higher probability of extreme events and in particular the higher probability of extreme losses versus extreme profits. These properties are known as excess kurtosis and negative skewness, respectively. The model can also describe the empirically observed volatility clustering and the reversion to a long-run volatility level and it also allows for analytically tractable option pricing.

Assuming the economy is driven by Heston's model, we compare four different strategies combined in two pairs – a fixed-mix and a target

volatility strategy, and a classical option-based portfolio insurance (OBPI) strategy and a target volatility strategy with an OBPI feature implementing a capital guarantee. In our implementation, the target volatility is achieved through state-dependent rebalancing between the market index and the risk-free asset.

Fixed-mix strategies are traditional investment approaches. Typical examples include the 60-40 fixed mix between stocks and fixed-income, the 50-50 fixed mix, or the 40-60 fixed mix. They can be more or less aggressive depending on the (lower or higher) risk-aversion level of the investor which translates into a higher or lower proportion of stocks. Fixed-mix strategies can be viewed as target volatility strategies in a constant volatility economy and, thus, comparing them to true target volatility strategies measures the consequences of trying to control volatility through a traditional fixed-mix in a stochastic volatility environment. The comparison with the target volatility strategy is done both in terms of utility loss and distributional properties of the pay-off at the investment horizon.

Another traditional strategy that is tested is a long-only investment with a capital guarantee feature implemented through a call option written on the underlying. The option provides a protection on the downside while the performance of the underlying asset provides upside potential. It is compared to a target volatility strategy to which a capital guarantee feature is added. This allows us to see the value added of the improved upside potential of the target volatility underlying within the OBPI structure.

*"The target volatility strategy has a positive skewness and almost no excess kurtosis which means both the downside and the upside of the return distribution are improved. This conclusion is confirmed by comparing the OBPI strategies where the downside risk is completely removed"*

The improved upside potential appears as a consequence of the dynamic rebalancing which, apart from controlling volatility, increases the probability of getting positive returns and also reduces extreme risk by making the downside of the asset return distribution at the investment horizon more Gaussian-like. As far as the capital guarantee is concerned, in this paper we consider a level of 90% but the particular level is a matter of choice; our results are general.

To carry out the comparison in a realistic setting, we fit Heston's model to Asian market data. The estimation methodology allows us to consider economies that are relatively more integrated with the world economy. Fitting Heston's model parameters to South Korea's KOSPI 200 index and Hong Kong's Hang Seng index reveals a significantly higher long-run level of volatility and also a more negative correlation between instantaneous volatility and the market index returns compared to the US market represented by the Standard & Poor's 500 Stock Price Index (S&P 500). More importantly, we find that the constant volatility model is strongly rejected for the three markets which, from an academic perspective, is not surprising but provides support for target volatility strategies. Apart from parameter values as estimated from historical data, we also consider a scenario

with a higher volatility of volatility representing a bigger deviation from the constant volatility case. A motivation for this is the fact that the volatility of volatility is generally difficult to estimate and it is important to size up the implications in case it is underestimated.

Having fitted Heston's model, we generate 10,000 sample pairs of sample paths for the market index and the instantaneous volatility for a 10-year investment horizon using the fitted parameters for the Hang Seng index and, for each pair of paths, we calculate the realised return of the four strategies. Then, we compare the benefits in terms of investors' expected utility and also in terms of different distributional characteristics of portfolio value at the investment horizon and different path-wise properties. Apart from the value-added, we also look at the cost of implementing the structured product which, in this case, depends on the price of the options. Ultimately, the main objective is to draw a conclusion about the value added of the customised structured equity product in different volatility environments.

**O**ur first important finding is that the return distribution of the fixed-mix at the investment horizon in the stochastic volatility economy under consideration is significantly negatively skewed and has excess kurtosis. These properties imply higher downside risk and unattractive upside potential. In stark contrast, the target volatility strategy has a positive skewness and almost no excess kurtosis which means both the downside and the upside of the return distribution are improved. This conclusion is confirmed by comparing the OBPI strategies where the downside risk is completely removed because of the capital guarantee and the upside potential depends entirely on the features of the underlying asset.

Besides shedding new light on the distribution properties of these strategies at the investment horizon, we find a significant appetite for target volatility strategies exhibited by risk-averse investors with and without the option overlay. We consider a two-period setting which is a realistic assumption because structured investment products are usually held to maturity. Firstly, we observe a higher expected utility for target volatility products which becomes more pronounced for higher levels of risk aversion. In particular, the target volatility strategy is preferred to the fixed mix by risk-averse investors at any level of risk aversion. In a similar vein, the OBPI strategy with a target volatility underlying exhibits a better upside potential and, in the high volatility case, the strategy becomes attractive to a broader set of investors compared to the standard OBPI.

Secondly, when added to the investment universe, the portfolio maximising investors' expected utility contains a significant allocation to a structured investment strategy. In the base case for example, investors for which the 40-60, 50-50 or 60-40 fixed mix strategies of bonds and stocks are optimal would invest about 90%, 76% and 62% respectively in a target volatility product with equity as underlying designed to have a constant annualised volatility of 18%. Further on, if we assume the demand for the structured investment strategy is driven by a set of investors with uniformly distributed risk-aversion levels for which the optimal fixed mix is between 20-80 and 80-20, then the average allocation to the same target volatility strategy is about 57% in both the base case and the high volatility case. The average allocation to the target volatility OBPI product, however, increases from about 36% to about 63%, implying that a capital guarantee feature

would be much more demanded in environments where the stochastic nature of volatility is more pronounced.

We reach similar conclusions about investor preferences assuming that investors evaluate investment options only in terms of mean and downside risk as measured by conditional value-at-risk (CVaR).

Computing the access to the upside for the OBPI strategies, we find that protecting an underlying with target volatility is generally easier and could be cheaper than protecting an underlying whose volatility is left to its own devices. We demonstrate that the classic Black-Scholes framework can be used to price the corresponding call option. While the implementation of the target volatility itself can be associated with significant turnover, in the context of Heston's model this can be dealt with by adapting the frequency of rebalancing.

To summarise, our results indicate target volatility products can be attractive to investors for at least four reasons. Firstly, they allow for an explicit management of volatility which is impossible to get with the classical investment approaches or products assuming a stochastic volatility setting. Being able to control volatility is important for any problem involving risk budgeting. Secondly, they can be combined with options in an insurance strategy providing a pay-off profile with capital guarantee and an improved upside potential. This is especially important for underfunded long-term investors that need access to the equity risk premium while respecting short-term risk budgets. Thirdly, institutional investors required to hold risk-based capital can benefit from the stabilising effect of the fixed volatility on the dynamics of the capital charge making it easier to maintain. Finally, from an investment banking perspective, providing a capital protection feature is much easier when the underlying strategy has a fixed volatility implying greater affordability of the product for investors.

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#### References

- Goltz, F., L. Martellini, and K. Simsek (2008). Static Allocation Decisions in the Presence of Portfolio Insurance. *Journal of Investment Management*, 6 (2): 37–56.
- Hens, T. and M. Rieger (2009). The dark side of the moon: structured products from the customer's perspective. EFA 2009 Bergen Meetings Paper. Available at SSRN: <http://ssrn.com/abstract=1342360>
- Heston, S. L. (1993). A closed-form solution for options with stochastic volatility with applications to bond and currency options. *Review of Financial Studies* 6 (2): 327–343.
- Heston, S. L. and S. Nandi (2000). A closed-form GARCH option valuation model. *Review of Financial Studies* 13 (3): 585–625.
- Merton, R. C. (1969). Lifetime portfolio selection under uncertainty: The continuous time case. *Review of Economics and Statistics* 51: 247–57.
- Merton, R. C. (1971). Optimum consumption and portfolio rules in a continuous-time model. *Journal of Economic Theory* 3: 373–413.
- Stoyanov, S. V. (2011). *Structured Equity Investment Strategies for Long-Term Asian Investors*. EDHEC-Risk Institute Publication supported by Société Générale Corporate & Investment Banking (SGCIB).

# Asian volatility indices and volatility products

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Recent market turmoil, as well as the presence of ever stricter regulatory constraints, has led investors and asset managers to monitor with increased scrutiny the volatility and downside risk of their equity holdings. In this context, market participants have shown increasing interest in volatility indices, which are not only heavily used as sentiment indicators, but also serve as underlyings for a number of derivatives contracts that can be used for obtaining long or short exposure to volatility. In this article, we first briefly review the methods for estimating volatility and then focus on the available volatility indices in Asia, their empirical properties, and the corresponding volatility products.

Volatility describes the uncertainty about the size of changes in an underlying security or index value. It is not an observable quantity and needs to be estimated. The academic literature distinguishes between two general approaches to equity volatility estimation – historical and option-implied. Within the historical approach, also known as backward-looking as it is based on past data, there are model-based estimators, such as GARCH volatility estimated through a formal econometric model, and model-free estimators such as the realised volatility measure computed from high-frequency data. The main disadvantage of model-based estimators is the inherent model risk while the main issue with realised volatility is the micro-structure noise of high-frequency data. Nevertheless, apart from their model-free nature, realised volatility measures are designed to make the volatility estimates less dependent on past data.

From an investor perspective however, option-implied volatility is more attractive. Because it concerns the market expectations of the spread of values of the underlying at maturity, it is also referred to as forward-looking. In this category, we also distinguish between model-based measures, usually based on the Black-Scholes implied volatility from at-the-money options, and model-free measures, which make use of all out-of-the-money puts and calls written on the underlying. Whether model-free or model-based, option-implied volatility is not the same quantity as the volatility of the return distribution of the underlying. Option prices are influenced by the level of risk aversion of investors, which has an impact on option-implied volatility – it is generally higher than realised volatility – a difference that reflects the readiness of investors to pay for protection also known as the volatility premium.

The notion of model-free option-implied volatility was first implemented by CBOE in the construction of the celebrated VIX indicator, which is inferred from prices of index options written on the S&P 500 index. VIX provides a measure of the market expectation of the 30-day volatility of the S&P 500 index and is

now the basis for a growing market of volatility products. Although the concept behind it has been adopted in other developed and emerging markets, VIX remains the most popular volatility index.

As far as the CBOE methodology goes, its precision has recently been a topic of research. Jiang and Tian (2007) discuss the CBOE implementation in detail and report several problems which can lead to economically significant errors. They demonstrate that the approach adopted by CBOE is identical to the model-free implied volatility published originally by Britten-Jones and Neuberger (2000) and note that its calculation requires out-of-the-money puts and calls with a continuum of strike prices ranging from zero to infinity and, as a consequence, the CBOE method introduces several sources of errors. Jiang and Tian (2007) calculate that for low levels of volatility (around 10%), the CBOE methodology overestimates the true implied volatility by about 7% and for high values of volatility (around 45%), the CBOE methodology underestimates the true implied volatility by about 4%. The authors also calculate that the overestimation and underestimation of VIX can be up to 79 and 198 index points respectively and has a potential economic impact on the entire volatility derivatives market as it implies mispricing of VIX futures, options, and variance swaps.

Although imperfections in the CBOE methodology may have an impact on the estimated level of volatility with the corresponding implications for the volatility derivatives, they do not seem to exercise a substantially adverse effect on the empirical relationship between the market index returns and VIX. Andersen and Bondarenko (2007) report a significant predictive power of VIX, of improved versions of VIX, and also of the Black-Scholes implied volatility. Apart from this paper, there is a significant body of literature on the power of option-implied volatility measures to predict realised volatility implying rich information content useful for both practitioners and academics (see Poon and Granger [2003] for a detailed survey of the academic literature).

Finally, from the standpoint of investors, we can identify three key motives for trading in volatility: (i) equity risk diversification which relies on the negative correlation between volatility and equity returns that is even more pronounced in market downturns, (ii) volatility exposure hedging by institutions with an already existing exposure to volatility, and (iii) directional and non-directional speculative bets relying on the mean-reverting behavior of volatility (see Goltz et al [2011] for additional references and details). The presence of these motives explains the significant demand for volatility products, the most popular of which include volatility futures, volatility options, and variance swaps. ▶

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## Asian option-implied volatility indices

Any model-free option-implied volatility relies on existing and properly functioning index option markets. Among the Asian stock index option markets, the KOSPI 200 contract stands out as it has liquidity<sup>1</sup> greater even than the S&P 500 contract. The S&P CNX Nifty index ranks after the EuroStoxx 50 contract (see table 1 for further details). Although Nikkei 225 index options were launched in 1989 and Hang Seng index options were launched in 1993 they are a lot less liquid than the KOSPI 200 contract launched much later, in 1997.

The importance of the maturity of the index options market was pointed out by Bhabra et al (2001) who studied Korean implied volatility for the period July 1997 to March 1998 shortly after the introduction of the index option contract. The authors report that the implied volatility derived from the Korean index options market was unable to foreshadow the 1997 economic crisis in Korea. The study indicates that option traders reacted to the crisis as it intensified rather than exhibiting fear of the impending market downturn. As a result, relatively young and immature option markets may be unable to generate informative forward-looking volatility indicators.

Due to a lack of uniformly well-developed stock index option markets in Asia, CBOE-style implied volatility indices are available only for six of the Asian stock markets, namely, Australia, Hong Kong, India, Japan, South Korea and Taiwan (see table 2 for additional details). Most providers have released methodology notes having different level of detail, the only exception being AlphaShares with no publicly available methodology notes. Compared to VIX, some providers follow the CBOE methodology exactly (eg, SPAVIX) while others deviate from it but preserve its spirit.

In line with the empirical literature on the US market, empirical studies on Asian volatility have generally concluded that option-implied volatility measures perform better at forecasting future realised volatility than historical volatility measures and exhibit a strong relationship with the market index returns, see for example Fung (2007), Yang and Liu (2012), and Han et al (2012).

As far as the criticism of Jiang and Tian (2007) is concerned, since Asian model-free option-implied volatility indices are generally based on a technology that is very similar to the CBOE method, similar conclusions would hold.

## Volatility products in Asia

A common argument articulated by finance professionals is that in times of significant market crashes equity volatility increases across all markets. Therefore, investors across the world can use the most liquid volatility derivatives market to buy protection rather than opt for local volatility derivative products in the event that they are available. The most liquid such market is that of VIX derivatives and, so the argument goes, buying a VIX product is supposed to provide sufficient protection. This is supposed to hold true for investors based in both developed and emerging markets and there is general support coming from empirical research (see Poon and Granger [2003]<sup>2</sup>).

In Asia, there are both developed and emerging markets and, to check the relevance of the argument, we look at the literature on

<sup>1</sup> The ranking by liquidity of the index option market is based on the average notional value.

<sup>2</sup> Poon and Granger (2003) note that it is a stylised fact of volatility that correlation among volatility is stronger than correlation among returns and both tend to increase during bear market and financial crises.

## 1. Top eight equity index futures and options contracts

Rank	Contract	Index multiplier	Number of contracts traded, 2011	Average notional value (\$), 2001
1	KOSPI 200 Options, KRX	KRW100,000	3,671,662,258	86,136,713,743,212
2	S&P 500 Index Options, CBOE	\$100	197,509,449	25,037,062,712,471
3	EuroStoxx 50 Index Options, Eurex	€10	369,241,952	13,426,186,189,265
4	S&P CNX Nifty Index Options, NSE India	INR100	868,684,582	9,930,331,813,352
5	DAX 30 Options, Eurex	€5	67,616,997	3,101,026,508,585
6	TA-25 Index Options, TASE	NIS100	87,133,824	2,928,128,944,826
7	TaieX Options, TaieX	TW\$50	125,767,624	1,744,931,959,939
8	Volatility Index Options, CBOE	\$100	97,988,951	237,158,536,348

Source: www.futuresindustry.com. The average notional value is calculated by multiplying the number of contracts traded by the multiplier and then by the corresponding average index value and average exchange rate where the averaging has been done on the daily values in 2011.

## 2. Asian implied volatility indices and products

Country	Bloomberg ticker	Underlying index	Provider	Start of historical data
Australia	SPAVIX	SP/ASX 200	S&P, ASX	2 Jan 2008
China/Hong Kong	ASCNCHIX	FTSE/Xinhua 25, Hang Seng	AlphaShares	3 Jan 1999
Hong Kong	VHSI	Hang Seng	HKEX	2 Jan 2001
India	INVIXN	Nifty 50	NSE	1 Nov 2007
Japan	VNKY	Nikkei 225	OSE	4 Jan 2001
South Korea	VKOSPI	KOSPI 200	KSE	2 Jan 2003

The table has been produced using different sources – Australia Stock Exchange, Hong Kong Stock Exchange, National Stock Exchange of India, Osaka Stock Exchange, Korea Stock Exchange and the Bloomberg database. The start date is based on the availability of data from the Bloomberg database.

the volatility spill-over mechanisms based on different volatility measures. In spite of the general nature of the argument outlined above, it turns out to be incomplete because the transmission mechanism of volatility spill-over has been found to be generally from developed to emerging markets. Beirne et al (2009) study 41 different emerging markets including 12 Asian ones using GARCH-type volatility and conclude that the volatility of matured markets significantly affects the conditional volatility of emerging markets; the exceptions in Asia being China, India and the Philippines.

Using a different methodology based on a form of realised volatility, Wang (2011) reports a similar finding. Asian volatility is found to be driven by local factors and the local factors appear to be strongest for India and China.

Padhi (2011) reports similar results using only forward-looking option-implied volatility indicators focusing on the Asia-Pacific markets for which such indices are available, the US, and Germany. The paper concludes that generally the VIX has the highest causality effect. For Indian volatility in particular, no option-implied volatility indicator seems to exercise any signifi-

cant influence. The explanation provided in the paper is the relatively low degree of integration of the Indian equity market with the global financial system.

These empirical papers suggest that although we can make the case for using VIX derivatives for protection in times of severe market crashes, if investors are significantly exposed to Asian emerging markets they may be left unprotected from market-specific events or, in the event that the spill-over mechanism is not pronounced, the protection may be inadequate (eg, India or China). Market-specific events, in the event that there is no spill-over, may leave investors unprotected even in developed markets.

Currently, however, the availability of volatility derivative products in Asia is very limited. The Hong Kong stock exchange was the first Asian stock exchange to launch volatility index futures in February 2012. Osaka stock exchange launched trading of Nikkei 225 volatility index futures a week after the HSI volatility index futures were launched. Table 3 illustrates how thin the two markets have been since product launch. The numbers in the table represent the number of contracts. The detailed daily

## 3. Monthly statistics: HSI and Nikkei 225 volatility index futures

Month		Contract volume	Open interest	
		Average daily	Total	
HSI Volatility Index Futures	2012 02	9	69	11
	2012 03	10	220	39
	2012 04	11	196	129
	2012 05	16	353	27
	2012 06	5	115	77
	2012 07	4	74	29
	2012 08	7	169	54
	2012 09	4	81	69
	2012 10	10	196	41
	Nikkei 225 Volatility Index Futures	2012 02	55	166
2012 03		134	2,824	734
2012 04		18	352	10
2012 05		4	92	28
2012 06		40	838	226
2012 07		44	915	297
2012 08		53	1,216	269
2012 09		55	1,041	429
2012 10		70	1,544	514

Source: Hong Kong Stock Exchange and Osaka Stock Exchange.

◀ statistics on the Hong Kong stock exchange indicate that market participants focus almost entirely on the one- and two-month maturity futures.

Apart from volatility futures, another popular type of volatility derivative is the variance swap. Variance swaps are available for KOSPI 200, Nikkei 225, ASX 200 and HSI.<sup>3</sup> However, like volatility futures, liquidity is generally limited, with the HSI variance swaps being the most liquid in relative terms.<sup>4</sup>

### Summary

Model-free option-implied volatility has been introduced on several Asian markets – Australia, Hong Kong, India, Japan, South Korea and Taiwan. Research conducted for Asian markets supports the empirical connection between local volatility indices and equity returns established otherwise for the European and the US market. Further on, empirical research suggests significant spill-over effects from the developed markets to the Asian markets but also suggests a significant market specific volatility component for some markets. As a consequence, investors with Asian equity exposures may be willing to consider Asian volatility products for diversification, hedging, or speculative bets. At this stage, however, volatility futures are available only on the Hong Kong and Osaka stock exchanges, with limited liquidity.

### References

- Andersen, T. and O. Bondarenko (2007). Construction and Interpretation of Model-Free Implied Volatility. In *Volatility as an Asset Class* Ed. Israel Nelken, 141–185, Risk Books.
- Beirne, J., G. Caporale, M. Schulze-Ghattas and N. Spagnolo (2009). Volatility Spillovers and Contagion from Mature to Emerging Stock Markets. European Central Bank, Working Paper Series N1113.
- Bhabra, G., M. Gonzales, M. Kim and J. Powell (2001). Volatility Prediction During Prolonged Crises: Evidence from Korean Index Options. *Pacific-Basin Finance Journal* 19 (2): 147–164.
- Britten-Jones, M. and A. Neuberger (2000). Option Prices, Implied Price Processes, and Stochastic Volatility. *Journal of Finance* 55 (2): 839–66.
- Fung, J. (2007). The Information Content of Option Implied Volatility Surrounding the 1997 Hong Kong Stock Market Crash. *Journal of Futures Markets* 27 (6): 555–574.
- Goltz, F., R. Guobuzaitė and L. Martellini (2011). *Introducing a New Form of Volatility Index: The Cross-Sectional Volatility Index*. EDHEC-Risk Publication, January.
- Han, Q., B. Guo, D. Ryu and R.I. Webb (2012). Asymmetric and negative return-volatility relationship – the case of VKOSPI. *Investment Analyst Journal* 76: 69–78.
- Jiang, G. and Y. Tian (2007). Extracting Model-Free Volatility from Option Prices: An Examination of the VIX Index. *Journal of Derivatives* 14 (3): 35–60.
- Padhi, P. (2011). On the Linkages among Selected Asian, European and US Implied Volatility Indices. NSE Working Paper WP/3/2011, National Stock Exchange of India Limited.
- Poon, S-H. and C. Granger (2003). Forecasting Volatility in Financial Markets: A Review. *Journal of Economic Literature* 61: 478–539.
- Yang, M. J. and M-Y. Liu (2012). The forecasting power of the volatility index in emerging markets: Evidence from the Taiwan stock market. *International Journal of Economics and Finance* 4 (2): 217–231.
- Veerappan, S. and L. Han (2012). *Downside Protection Strategies – Considerations for Asian Investors*. Russell Research, Russell Investments.
- Wang, J. (2011). Forecasting Volatility in Asian Stock Markets: Contributions of Local, Regional, and Global factors. *Asian Development Review* 28 (2): 35–57.

3 Based on various swaps available in the Bloomberg database.

4 Veerappan and Han (2012).

# Key results of the EDHEC-Risk Asian Index Survey

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Indexation continues to play an important role in global asset allocation. Total worldwide assets under internal indexed management rose from \$4.781trn to \$5.994trn as of 30 June 2011 – a 25% increase from one year earlier (Olsen [2011]). In view of the growing volume in assets under management in passive indexing strategies, a great many index providers have emerged worldwide; not only the organisations specialising in the index service but also stock exchanges as well as investment banks. Each provider has created or is creating a host of indices representing a full complement of asset classes, as well as asset class segments.

In the history of indices, country-based capitalisation-weighted indices have proved to be the most popular indices for both equity and bond markets. Such indices are often used as a bellwether for the economy, as they are supposed to represent market trends. Today, a growing demand for indices as investment vehicles has led to innovations including sector, style and size based indices which provide exposures to specific risk factors.

As the choice of an index is a crucial step in both asset allocation and performance measurements, it is useful to investigate index use and perceptions about indices. In fact, relatively little is known about the views of potential users of indices in the Asia Pacific region. The EDHEC-Risk Asian Index Survey, supported by Amundi ETF, was the first comprehensive survey of Asian investment professionals which aimed to analyse the current uses of and opinions on stock and bond indices. It is our hope that this survey will provide unique insight into the users' perspective of the index industry.

The survey was conducted during April and May 2011, and received a total of 127 responses.

The respondents provided a balanced picture of the Asia Pacific asset management industry and include asset managers, institutional asset owners, investment consultants and private wealth managers of different size categories. While we have included Japan in the survey, responses from Japan are relatively low, at 4% of total respondents. Thus the survey mainly represents respondents from Asia Pacific excluding Japan, and in particular the major asset management centres of Australia, Hong Kong and Singapore, which each account for roughly 20% of overall respondents.

### Respondents' usage and perception of standard market indices

We first provide an overview of overall usage rates and satisfaction rates of index users across indices for different asset classes. Note that these results relate to the indices themselves, rather than to investable products that would track such indices. Table 1 provides an overview of these results.

Overall, our findings suggest that index use is relatively widespread in equity indices but much lower for bond indices. While almost 90% of equity investors who respond to our survey use equity indices, only about 50% of government bond investors use indices for this asset class, and the usage rate is lower for corporate bond indices. The satisfaction rate for indices is moderate for equity, at about 71%. For bond indices, the satisfaction rate is even lower (49.2% for government bond indices and 59.8% for corporate bond indices).

The results show, that while indices are relatively widely used in all asset classes, satisfaction rates are moderate to low. A potential explanation for this is that, despite obvious

## 1. Summary of the usage of and satisfaction with indices in different asset classes

	Equity	Government bond	Corporate bond
If you invest in this asset class, have you used indices for these investments?	88.5%	51.5%	40.8%
Are you satisfied with the index products you have used in each asset class?	71.1%	49.2%	59.8%

Percentages shown in this table have been normalised by excluding the non-response for each question. Percentages shown in the second row are obtained by those who have used indices for their investment in respective asset class.

advantages such as liquidity, transparency, and cost efficiency when implemented as investments, standard indices also come with a number of issues. The recent literature has cited several issues with indices. With our unique sample of investment management practitioners from Asia-Pacific, we had the opportunity to verify whether these points are indeed shared by practitioners. Also, given that we cover not only equity indices but also bond indices in our survey, we are able to assess which issues are most pronounced according to the view of practitioners for indices in each asset class. These practitioner views may also be useful feedback for index providers who are looking at developing improvements over the currently available indices.

The standard market indices in equity and bond markets have been capitalisation-weighted and debt-weighted indices. For equity indices, research has raised the issues of overinvestment in the overpriced stocks (Hsu [2006]), and concentration in a few large stocks (Tabner [2007] and Malevergne et al [2009]), which leads to relatively poor diversification. In the case of bond indices some of the issues observed are similar to equity indices, like the so-called bums problem. This problem refers to the fact that issuers with a large amount of debt outstanding account for a relatively large fraction of the total debt market. It has thus been argued that bond indices that are debt-weighted may have a tendency to be overinvested in rather risky assets. We can see that this problem bears some resemblance to the problem of overinvestment in overpriced stocks as in the case of equity indices. However, there are other issues that are different from equity indices and unique to bond indices. Such commonly cited issues are the pricing difficulties (Elton and Green [1998]) and unstable duration or credit risk exposures (Siegel [2003], Benning [2006] and Campani and Goltz [2011]), for example. When considering the problems pointed out in the existing literature, it thus appears that challenges when constructing indices differ across asset classes.

Our survey assesses the importance of such issues to index users. Table 2 shows the important issues that respondents have across different asset classes.

All of these issues listed in the table have received a high importance ranking by the average respondent to our survey (importance level of at least 1.95 on a scale from -1 to 3). The findings of our survey make it clear that the issues investors see with existing indices differ across asset classes. Equity investors fear overinvestment in overpriced stocks and insufficient diversification/size biases due to concentration of the indices in a small number of often highly correlated stocks. Fixed-income investors, by contrast, are more likely to be concerned by duration stability and liquidity of the indices. These results suggest that investors in a given asset class need indices that provide solutions to problems that are different from those faced by investments in other asset classes. Overall, our results imply that a potential path for index providers in terms of future development may be to think about index construction methods that are specific to a given asset class rather than trying to apply a given index construction principle to various different asset classes without considering the specific issues at hand.

### Defining the index universe: indices for sub-segments of a broader universe

Within a given investment universe (such as 'Asian equity'), investors have different ways of defining the relevant subcategories, if any. This

## 2. Comparison of important issues associated with indices across different asset classes

Equity	Government bond indices	Corporate bond indices
<ul style="list-style-type: none"> <li>➤ Overinvestment in overpriced stocks</li> <li>➤ Poor diversification</li> <li>➤ Sector and size biases</li> <li>➤ Lack of representation</li> </ul>	<ul style="list-style-type: none"> <li>➤ Difficult to invest/replicate</li> <li>➤ Instability of duration</li> <li>➤ Inconsistent security selection rules and non-systematic pricing</li> </ul>	<ul style="list-style-type: none"> <li>➤ Overinvestment in more risky companies</li> <li>➤ Lack of liquidity</li> <li>➤ Unreliable credit exposure</li> </ul>

question is of practical importance as it will guide implementation through the respective indices, such as broad indices, country indices, sector indices, etc. Perhaps more importantly, the choice of subcategories will determine how investors exploit the diversification opportunities within the universe. In the academic literature, the definition of breakdowns into subcategories or 'basis assets' has received a fair amount of attention as tests of asset pricing models may depend on how the categories are chosen (see Lewellen et al [2010] or Ahn et al [2009]). In investment management, results of asset allocation studies may depend in a similar manner on how sub-segments are formed. For example, there is a regular discus-

*"Equity investors fear overinvestment in overpriced stocks and insufficient diversification/size biases due to concentration of the indices in a small number of often highly correlated stocks. Fixed-income investors, by contrast, are more likely to be concerned by duration stability and liquidity of the indices"*

sion on whether sectors, styles or countries are more relevant ways of forming sub-segments of global or regional equity universes (eg. Hamelink et al [2001], Ferreira [2006], Errunza et al [1999]). In particular, research assesses whether diversification effects are stronger within the universe for certain segmentational approaches. Our survey allows us to assess which segmentations investors prefer. It is also interesting to assess which segmentation approaches are preferred across different geographic investment universes. For instance, one might expect that segmentation approaches could differ between equity portfolios covering relatively homogenous countries (such as a European equity portfolio) and universes covering more heterogeneous countries (such as an Asia equity portfolio).

In order to assess which equity index cat-

egorisation (segmented equity indices based on style, size, sector, country, etc) is more relevant according to the views of practitioners, we first asked investors to rank the importance of various kinds of equity indices which correspond to different segmentation approaches.

Table 3 shows the overall importance of broad indices as well as various segmentations. The results are reported in terms of scores, where an increasing score signals increasing importance. The results show that broad indices (regional or worldwide indices and to a lesser extent country indices) are much more important than segmented indices (sector, size, style segment indices). It is also clear that among the ways of forming sub-segments, sector indices are seen as more important than size, style and factor indices.

With a perspective on overall preference of equity indices amongst investors, we asked the investors how they would like to handle the segmentation of their universe when using equity indices in different geographic universes. The basic idea is that it is possible that different geographic investment universes lead to different segmentations. For each investment universe, we asked the respondents to choose their top three segmentation approaches, indicating the importance of each, ie, from one to three). The results are reported in terms of scores in table 4, where an increasing score signals increasing importance of a particular choice. The results show that there exists a significant difference when comparing the importance of using a sector breakdown to the importance of using a style breakdown. Within all investment universes, a sector definition is more important than a style definition. This can potentially be explained by the fact that Asian investors still adhere to a tradition based on fundamental analysis, which tends to specialise in sectors. Styles, which are a more common notion in countries with a strong focus on multi-management and for manager selection (such as the UK and US) are not widely used in Asia.

We also perform statistical tests on the results above to see whether differences are statistically significant. Two types of statistical tests are performed. The first type of test looks at differences of practices across geographic universes, ie, we assess whether the type of breakdown used may depend on the invest- ▶

## 3. Do you think the following types of equity indices are important to your portfolio construction process?

Types of indices	Regional or worldwide	Country	Sector	Size-segment	Style (value/growth)	Factor-based
Average score	2.28	2.20	1.78	1.39	1.30	1.02
% not important at all	4.4%	5.2%	11.2%	14.9%	18.3%	24.3%
% important and very important	85.0%	81.9%	67.2%	52.5%	49.6%	40.0%

This table indicates the average scores received by breakdown. For each breakdown, respondents rate them as one of the categories - very important, important, slightly important, don't know, not important. Based on this scaled response we compute a score. The greater the score obtained the more preferred is a particular choice of breakdown. (Conversion from scaled response to score is done such that: very important = 3, important = 2, slightly important = 1, don't know = 0, not important = -1. Aggregated score of all respondents is reported.)

#### 4. For various equity universes defined below, how do you rate the importance of using the following types of indices?

Segmentation approach	Using a broad market index	Using sector indices	Using size-based indices	Using style-based indices	Separate indices for emerging and developed	Individual country indices	Regional indices
<b>Geographic universe</b>							
Investment in local country	n/a	1.28	1.28	0.49	n/a	2.42	n/a
Investment in Asia ex Japan	2.11	0.80	0.46	0.37	0.79	1.06	n/a
Investment in Asia	2.00	0.69	0.53	0.39	0.99	1.05	n/a
Investment focus that is oriented worldwide	1.91	0.76	0.42	0.32	0.89	0.66	0.67
Investment within Europe	2.05	1.03	0.62	0.40	0.66	0.92	n/a

This table indicates the average scores received by breakdown. For each investment universe set, respondents were asked to choose their top three preferred choices of breakdown and rank them. This rank is converted to a score, and the higher the score received the more preferred is that choice of breakdown in that investment universe set. Note that broad market index is n/a in first row because the individual country index is the broad market index. Regional indices were not provided as an option in the first three and the fifth case. Hence they are n/a.

ment universe. For example, we assess whether a sector breakdown is more important in an Asian investment universe than it is in a European investment universe or – perhaps more precisely – we test whether this difference is statistically significant. The second type of test assesses practices within a given geographic universe. It assesses whether the difference of importance of certain types of breakdowns within a given universe is statistically significant. For example, we test whether the greater importance of sector indices is indeed significant within a given universe.

Table 5 captures the key results from the significance tests concerning differences between geographic universes. Here we present results for only those comparisons where, not only is a test possible (similar breakdowns exist between the investment universe sets), but the test results are also significant. We note from table 4 that the choice of distinction between sector and emerging versus developed markets is high between European and Asian investment universes. Specifically, table 5 captures the most pronounced difference, which is between ‘investments in Europe’ and ‘investments in Asia’. The results show that in the Asian investment universe, using a breakdown by development stage of the market is more important than in the European investment universe. Using sector indices for the Asian universe is less important than it is within a European equity universe. Both differences between these two regions are highly significant, with a p-value of less than 1%.

In the second part of the statistical tests, as mentioned above, we hold the investment universe constant and assess whether within a given universe, a particular type of breakdown is more important than another. Specifically, we compare the relative importance of three types of breakdown – sector versus style indices; sector versus country indices, and country versus broad market indices. Table 6 summarises the results from this analysis.

The results reported in table 6 lead to three findings of significant differences between different types of breakdowns. The first panel shows that the higher importance of sector breakdowns compared to style breakdowns (which is apparent from the results in table 4) is statistically significant in all geographic universes. The second panel shows that a country breakdown is significantly more important than a sector breakdown in a regional Asian universe. Note that the difference of importance between country and sector breakdowns is insignificant within the other investment universes but this is not shown in table 6, which only reports statistically significant results. The implication of this result is that product providers that wish to provide useful tools for Asian investors concerning their investments in the Asian region likely need to pay more attention to developing country indices than to developing

#### 5. Statistically significant test results when comparison is done across different investment universe sets (Asia ex Japan, Asia and Europe) that have comparable breakdowns

	In Asia	In Europe	P-value of difference
Importance of using breakdown by emerging/developed markets	0.99	0.66	<0.01
Importance of using sector indices	0.69	1.03	<0.01

#### 6. Statistically significant test results when comparison is done across different breakdowns in investment (sector vs style, sector vs country, broad market index vs country) to assess their relative importance for a given investment universe set

##### Panel 1. Breakdown by sector versus breakdown by style

Investment universe	Importance of using	Importance of using breakdown by sector	P-value of difference breakdown by style
Local country	1.28	0.49	<0.01
Asia ex Japan	0.80	0.37	<0.01
Asia	0.69	0.39	0.018
Worldwide	0.76	0.32	<0.01
Europe	1.03	0.40	<0.01

##### Panel 2. Breakdown by sector versus breakdown by country

Investment universe	Importance of using	Importance of using breakdown by sector	P-value of difference breakdown by country
Asia	0.69	1.05	<0.01

##### Panel 3. Breakdown by country versus using broad market index without further breakdown

Investment universe	Importance of using	Importance of using breakdown by country without further breakdown	P-value of difference broad market index
Asia ex Japan	1.06	2.11	<0.01
Asia	1.05	2.00	<0.01
Worldwide	0.66	1.91	<0.01
Europe	0.92	2.05	<0.01

Only significant test results (with p-value <0.05) are reported.

sector indices. Panel 3 shows that the higher importance of broad market indices compared to country breakdowns (which was apparent in table 4) is statistically significant in all geographic universes.

The main findings of this assessment are thus: i) a predominance of sector breakdowns compared to style breakdowns, ii) a predominance of using a single broad index for a given geographic universe rather than a country breakdown, and iii) with an Asian investment universe, country breakdowns tend, nevertheless, to be more important and in particular are more important than sector breakdowns. While the second finding may be justified by the fact that cross-country diversification effects have tended to decrease over time (eg, Errunza et al [1999], Bakaert and Harvey [2000]), the first finding is clearly surprising. In fact, there is a consensus in both academia (see Fama and French [1993]) and practice (as shown by the widespread use of multi-factor models such as

Barra) that style factors such as value and size have strong explanatory power for expected returns. Despite this evidence on the importance of style factors, investors tend to attach relatively little value to taking into account style classifications when breaking down their investment universe and hence when defining their asset allocation.

#### Conclusion

Above we have summarised some main findings of our survey concerning usage rates, satisfaction and perceived issues with indices, and the preferences Asian investors have when defining and breaking down their beta.

In conclusion, our inference is two-fold. Firstly, usage of indices is much higher in equities than fixed income asset classes amongst Asian investors. Likewise, the satisfaction rates with indices are lower for bond indices when compared with equity indices. This could be attributed to specific issues with bond indices, such as difficulty

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◀ in investing and replication and risk/reward properties of these indices (such as instability of duration and a tendency to overweight high debt entities). Secondly, for portfolio construction in equities, Asian investors regard indices that allow a geographic approach (global, regional and country indices) as much more important than indices allowing for other segmentations. Looking at other ways to segment the universe, sector breakdowns appear to be those most relevant for investors and clearly more important than style and size based breakdowns. However, there are some differences in preferred segmentation depending on the investment universe. For example, segmentation by emerging and developed markets is more important for an Asian investment universe than for a European investment universe while segmentation by sector is more important for the European investment universe than of Asian investors.

*The research from which this article was drawn was supported by Amundi ETF as part of the research chair on Core-Satellite and ETF Investment at EDHEC-Risk Institute.*

*This research chair analyses the developments in the use of exchange-traded funds as part of the asset allocation process and looks at advanced forms of risk budgeting within the framework of a core-satellite approach.*

*The full version of the research is available on the EDHEC-Risk Institute website at the following address: [http://www.edhec-risk.com/indexes/Amundi\\_Research\\_Chair](http://www.edhec-risk.com/indexes/Amundi_Research_Chair)*

#### References

- Ahn, D. H., J. Conrad and R. F. Dittmar (2009). Basis assets. *Review of Financial Studies* 22 (12): 5133–5174
- Amenc, N., F. Goltz, M. Mukai, P. Narasimhan and L. Tang (2012). *EDHEC-Risk Asian Index Survey 2011*. EDHEC-Risk Publication supported by Amundi ETF.
- Bakaert, G. and C. Harvey (2000). Foreign speculators and emerging equity markets. *Journal of Finance* 55: 565–613.
- Benning, J. (2006). Benchmarking fixed-income returns. Chicago Board of Trade, working paper.
- Campani, H. C. and F. Goltz (2011). *A review of corporate bond indices: Construction principles, return heterogeneity and fluctuations in risk exposures*. EDHEC Risk Institute Publication.
- Elton, E. J. and T. C. Green (1998). Tax and liquidity effects in pricing government bonds. *Journal of Finance* 53 (5): 1533–1562.
- Errunza, V., K. Hogan and M. W. Hung (1999). Can the gains from international diversification be achieved without trading abroad? *Journal of Finance* 54: 2075–2107.
- Fama, E. F. and K. French (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics* 33 (1): 3–56.
- Ferreira, A. (2006). The importance of industry and country effects in the EMU equity markets. *European Financial Management* 12 (3): 341–373
- Hamelink, F., H. Harasty and P. Hillion (2001). Country, sector or style: What matters most when constructing global equity portfolios? Working paper. FAME.
- Hsu, J. (2006). Cap-weighted portfolios are sub-optimal portfolios. *Journal of Investment Management* 4 (3): 1–10
- Lewellen, J., S. Nagel and J. Shanken (2010). A sceptical appraisal of asset-pricing tests. *Journal of Financial Economics* 96 (2): 175–194
- Malevergne, Y., P. Santa-Clara and D. Sornette (2009). Professor ZIPF goes to Wall Street. Working paper. National Bureau of Economic Research.
- Olsen, K. (2011). Indexed assets surge 25%. *Pensions & Investments* (19 September).
- Siegel, L. B. (2003). *Benchmarks and investment management*. The Research Foundation of the Association for Investment Management and Research, Charlottesville, Virginia.
- Tabner, I. (2007). Benchmark concentration: Capitalization weights versus equal weights in the FTSE 100 Index. Working paper. University of Stirling.

# Who is afraid of construction risk?

Frédéric Blanc-Brude, Research Director, EDHEC Risk Institute–Asia

In this article, we make two important points about the role of construction risk in the design of efficient portfolios of infrastructure debt. First, the nature and characteristics of construction risk are still badly documented: construction risk in infrastructure project finance can be managed and, using new data, we show that it is lower than under traditional infrastructure procurement. Second, since an efficient portfolio of infrastructure debt must by definition achieve an optimal risk-return trade-off, and because construction risk may be remunerated with higher spreads during the construction period, including construction risk in debt portfolios should help achieve diversification benefits. In other words, it is likely that the efficient portfolio of infrastructure debt, which is also the benchmark for this category of investment, ought to include at least some construction risk, independently of investors' risk preferences.

These two points have important implications for institutional investors considering infrastructure debt as an investment opportunity, as well as for policy-makers who now find themselves having to guarantee construction risk in order to attract the same investors to the sector: if construction risk can be used to build efficient infrastructure debt portfolios there is little need to push it out of sight and into new public sector liabilities, except in specific cases. In what follows, we develop each point in turn.

## Construction risk is endogenous

Institutional investors might be sold on the 'infrastructure investment narrative' (Blanc-Brude [2012a]) but construction risk still makes them nervous. Incidences of large construction cost overruns in infrastructure projects are frequently reported, and it may seem sensible to keep such risks out of their portfolio. But whose risk do they have in mind?

Construction risk in greenfield infrastructure projects can spring from two factors. First, there is uncertainty about the conditions under which the numerous tasks associated with building a large structure can be accomplished: ground conditions, the weather, engineering challenges, unexpected archaeological sites, etc., all make the actual cost of building infrastructure uncertain. This uncertainty is highly idi-

osyncratic: projects are unique and usually built in different locations at different points in time. We will call these risks 'exogenous' – ie, no one can change their frequency distribution.<sup>1</sup>

The second category of uncertainty found in infrastructure project construction has to do with who is exposed to uncertain costs and what they can do about it. In economics, this is called an agency problem. If the risk of higher construction costs is not borne by the party in charge of building – as is the case in traditional public infrastructure procurement – there is moral hazard, ie, little incentive to control costs. Moreover, such procurement methods are also likely to suffer from adverse selection: the party selected to build the project may not be the best one when it comes to controlling costs.

Risk transfer through enforceable contracts deals very well with this situation: if the party building the project is made partly or fully responsible for the variability of costs, two things happen: the builder now has a strong incentive to control costs and, if enough risk is transferred, only those builders who know that they can control costs well will bid.<sup>2</sup> In other words, construction risk transfer leads to projects in which only the best builders manage their own construction risk.<sup>3</sup> It follows that a proportion of construction risk found in infrastructure projects is a function of who is exposed to it. We will call this risk 'endogenous' to the choice of procurement contract.

Thus, while exogenous construction risk is almost completely idiosyncratic, endogenous construction risk may be partly systematic if procurement choices encourage adverse selection and moral hazard. This is exactly what existing studies of construction risk show: the cost of building traditional infrastructure procurement is found to be systematically 20% over budget as figure 1 depicts (Flyvbjerg et al [2002]).<sup>4</sup> This 'optimism bias' is a good example of the consequences of moral hazard in procurement: bid prices are low because bidders are not much exposed to construction risk. Later on, costs go up.

Subsequent papers (Flyvbjerg and Holm [2003]; Flyvbjerg et al [2004]) show that cost overruns and delays breed more cost overruns, explaining why things can get so bad in some cases and thus why the observed frequency

1 But their impact at the project level may be managed through insurance contracts.

2 This is a separating equilibrium: we document such a case in the market for construction of PFI schools: some builders almost only bid for PFI construction contracts (fixed-price) and others only bid for traditional contracts (Blanc-Brude [2012b]).

3 A third thing that may happen is that only large firms that are in a position to diversify the exogenous risks described above can bid and there may be very few such firms. As a consequence, competition may be limited and prices higher than they otherwise would be, even after adding the builder's cost of carrying his own (fully-diversified) construction risk.

4 Flyvbjerg's dataset focuses on very large projects, some of which are private. Large private projects can carry very high and impossible to quantify exogenous risks (eg, Eurotunnel) or be too large for anybody to be in charge of cost control (eg, Metronet). But average projects with adequate risk transfer contracts are expected to leave mostly well known exogenous risk for builders to manage directly.

distribution is so skewed to the right. This double failure at construction risk measurement and management in traditional infrastructure procurement has been widely documented (Mott MacDonald [2002]). The construction risk of the public sector is high because endogenous risk is not managed through risk transfer.

Once construction risk is contractually transferred to the builder, does it change? Exogenous risk is fixed by definition but under a different incentive scheme we expect endogenous risk to be different. Infrastructure project finance creates such an incentive scheme: construction risk is typically transferred from the project company (InfraCo), which is the borrower of infrastructure debt, to the builder, which commits to a date-certain, fixed price construction contract. Of course, if a project's construction phase goes very wrong the risk may come back to the InfraCo, which is ultimately responsible. But since only the better builders bid for the risk transfer contract, we expect their own risk to be lower than the public sector's and insurable through a risk transfer contract.

Using a new dataset of ex ante construction prices and ex post construction costs in infrastructure project finance from the point of view of the InfraCo – the borrower of infrastructure debt – we observe that the risk of construction cost overruns in the project finance sample is almost completely idiosyncratic with a mean value of 3%, much lower than the 27% observed in public infrastructure procurement, and a median value of 0%.<sup>5</sup> Figure 1 also illustrates the fact that construction risk in project finance is much less extreme than in traditional procurement.

While this finding will not come as a surprise to project practitioners, this fact has not, to our knowledge, been documented until now. Next, we discuss the implications of the idiosyncratic nature of construction risk in project finance for debt portfolio construction.

### Building efficient infrastructure debt portfolios with construction risk

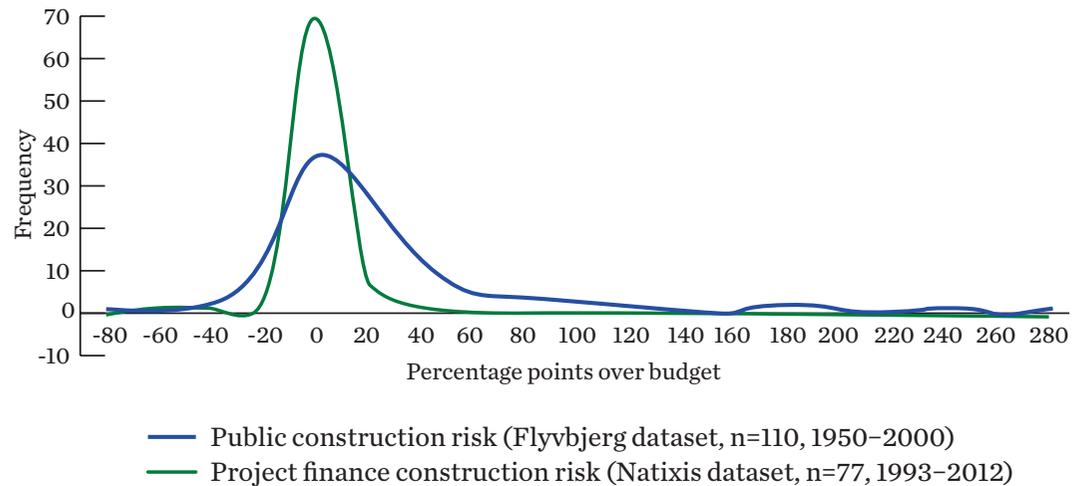
An efficient portfolio optimises the risk/return trade-off for a given level of risk preference: investors may want to have an exposure to infrastructure debt at a given credit risk level, say an 'A' rating. The question is to know what contribution construction-phase infrastructure debt can make to the efficient portfolio?

Two characteristics of credit risk during the construction period are instrumental to answering this question. First, construction risk may be idiosyncratic between projects but the period during which a project is being built is typically remunerated with higher all-in spreads. In other words, construction risk can be considered systematic within the project's life-cycle: it is always present at the beginning and always dissipates with time.

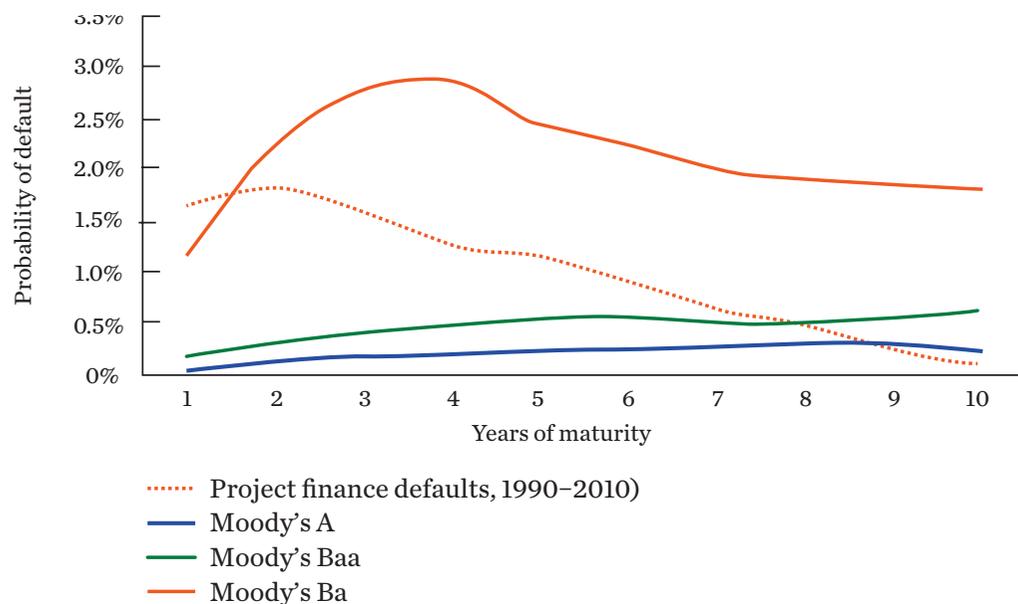
In effect the construction period is only the first phase of a project life-cycle that has been shown to systematically drive credit risk in project finance. In a recent study, using a sample of senior loans to more than 3,500 projects and spanning two decades, Moody's shows that project finance creates predictable credit risk transitions as a function of a term loan's date to maturity (Moody's Analytics [2012]). Over a period of 10 years, the average project finance term loan migrates from Ba (or

<sup>5</sup> The distribution of cost overruns in the Flyvbjerg and Natixis datasets is statistically different at the 1% significance level. A Welch two-sample t-test returns  $t = -4.4385$ ,  $df = 122.108$ ,  $p\text{-value} = 1.999e-05$ , rejecting the null hypothesis that both samples are similarly distributed.

## 1. Observed cost overruns in Flyvbjerg and Natixis examples



## 2. Average credit risk transition of infrastructure project finance debt



Source: Moody's (2012), sample size: 3,533 projects, period: 1990-2010

*"The idiosyncrasy of construction risk suggests that it should not be rewarded in a diversified portfolio, but its role in the credit risk transition path of project finance loans makes it a potentially potent diversifier, as long as each phase of the project life-cycle attracts a corresponding level of return"*

BB) to A as the project is built, ramps up and become fully operational, as illustrated in figure 2. This predictable average credit risk transition path suggests the opportunity to diversify debt portfolios across the life-cycle.

This is an important finding since, in a CAPM context, the idiosyncrasy of construction risk suggests that it should not be rewarded in a diversified portfolio, but its role in the credit risk transition path of project finance loans

makes it a potentially potent diversifier, as long as each phase of the project life-cycle attracts a corresponding level of return.

Second, the covariance between default rates, insofar as the default is triggered by construction risk, should be very low. Corporate loan default correlations are considered to be low in general (Saunders and Allen [2002]) but systematic factors may increase their correlation (eg, in the case of corporate debt, a recession would have this effect). This may also be true in project finance. As previous studies have documented, the incidence of defaults increased markedly in 1998, 2002 and 2009 (Moody's Analytics [2012]). However, it should be obvious that the correlation between the business cycle and the covariance of infrastructure debt defaults is independent of construction risk. On the contrary, as we argued above, if project finance construction risk is idiosyncratic between projects, defaults triggered by construction risk should be mostly uncorrelated. The bankruptcy of the builder, to the extent that it is involved in the construction phase of several projects at the same time, may be a positive driver of correla- ▶

◀ tions between default rates. Still, we expect default correlations to be low when it comes to the impact of construction risk on credit risk in project finance.

Combining assets with different risk/return profiles and low correlations can create diversification benefits. There is a number of potential combinations of these assets that delivers the optimal trade-off between risk and return: a line representing all such combinations, usually called an efficient frontier, can illustrate the solution to this classic optimisation problem (figure 3). At one end of the frontier (point O), all funds are invested in the one least-risky asset; at the other end (point C), the most risky asset receives a weight of 100%. Independently of an investor's risk preferences, the benefits of diversification are visible in the concavity of the frontier: it makes no sense to invest only in the low risk asset since a higher level of return can be achieved for the same level of risk by combining different assets. Even the minimum risk point on the frontier (point A) corresponds to an allocation to some risky asset.

With infrastructure debt, at a simplistic level, we have two assets: construction period debt with a Ba credit risk and post-construction period debt with an A rating. In effect, the continuous credit transition shown in figure 2 suggests the opportunity to diversify across each

“Hundreds of schools, hospitals and public buildings as well as dozens of standard transport and energy projects are both what the economy needs and what investors should require in order to have access to the infrastructure investment narrative”

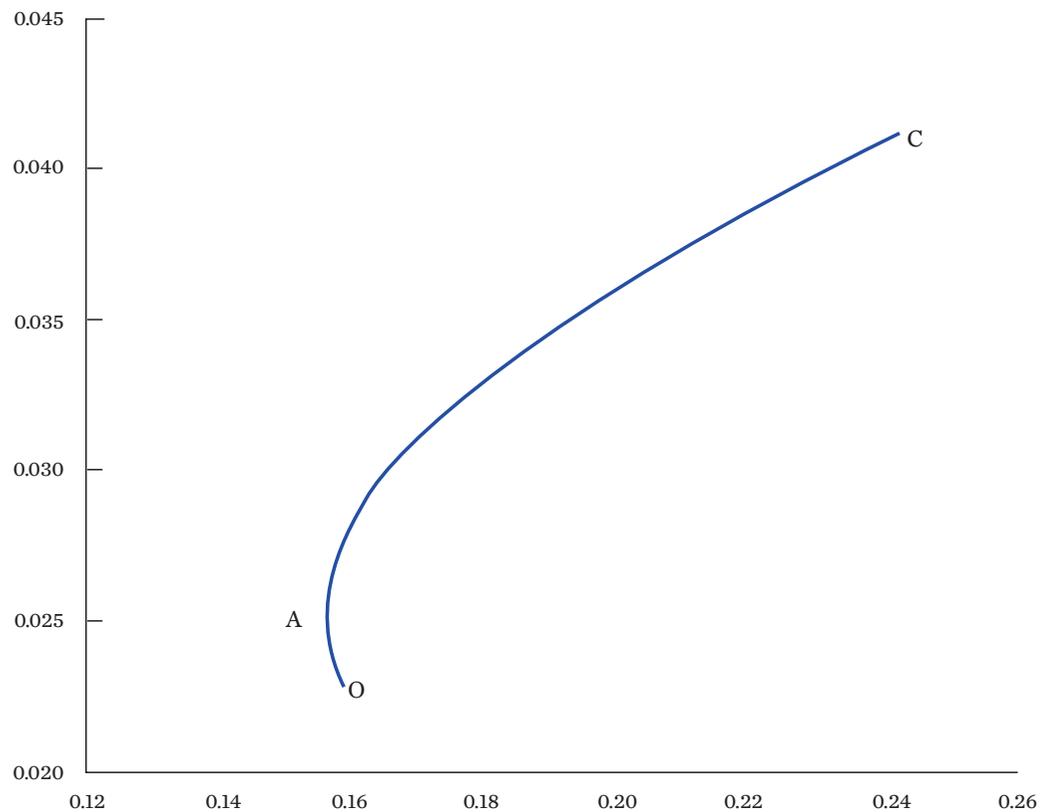
year of the lifecycle of infrastructure term loans. As long as the efficient frontier of infrastructure project finance debt portfolios is a little concave, as illustrated on figure 3, then even at the lowest risk point, the efficient portfolio will contain some construction-period debt since the point on the frontier that would correspond to investing only in post-construction debt lies below the minimum risk point.

It follows that investors in infrastructure debt should actively seek to invest in construction risk!

Another important consequence of the predictability of credit transitions in project finance debt is the necessity of a dynamic approach to portfolio construction: whichever combination of term to maturity and the resulting portfolio credit risk has been chosen by an investor, new debt at different maturities needs to be added to the portfolio at regular intervals to maintain its risk profile.

This point also has important implications for public procurement. If governments want institutional investors to finance infrastructure investments, significant capacity in infrastructure debt has to develop since debt represents, on average, 75% of a project's capital programme financing (Blanc-Brude et al [2010]). In turn, if project finance debt portfolios need to be dynamically managed then the predictability of

### 3. Efficient portfolio construction frontier with two fixed income assets rated ‘Ba’ and ‘A’ (daily returns, 10 years)



the deal flow becomes important: at the aggregate level, each period requires the origination of new greenfield debt to replace the maturing construction risk found in debt portfolios at the previous period.

This is good news for governments that want to see more investment in greenfield infrastructure and for investors who need a recognisable beta to invest in. Still, a lot more work is needed to benchmark infrastructure debt investments and to coordinate public and private objectives. This and other research questions relating to infrastructure debt instruments are the focus of a new Natixis/EDHEC-Risk Institute research chair.

Finally, where does that leave public sector initiatives to guarantee construction risk? When exogenous construction risk is high and hard to quantify in the case of very large projects (think Messina Strait) or if its contractual management is too difficult (think London Underground) then public sector guarantees will help. But are these really the projects we have in mind when we talk about betas or asset classes? Hundreds of schools, hospitals and public buildings as well as dozen of standard transport and energy projects are both what the economy needs and what investors should require in order to have access to the infrastructure investment narrative. If this kind of pipeline can be developed, construction risk will be a welcome diversifier in debt portfolios and financing infrastructure construction risk with institutional money should become standard practice.

*The research from which this article was drawn was supported by Natixis as part of the research chair on Investment and Governance Charac-*

*teristics of Infrastructure Debt Instruments at EDHEC-Risk Institute.*

*The Natixis/EDHEC-Risk Institute research chair's first paper, "Who is Afraid of Construction Risk?" examines the nature and investment characteristics of infrastructure project finance debt and issues around portfolio construction and benchmarking.*

*It will be published in March 2013 on the occasion of the EDHEC-Risk Days Europe conference in London.*

#### References

- Blanc-Brude, F. (2012a). *Infrastructure portfolio construction: in search of an asset class*. ijonline.com.
- Blanc-Brude, F. (2012b). Risk Transfer, Self-Selection and Ex Post Efficiency in Public Procurement: An Example from UK Primary and Secondary School Construction Contracts. *Revue d'Économie Industrielle* 140 (4ème trimestre 2012): 1–25.
- Blanc-Brude, F., O. Jensen and C. Arnaud (2010). *The project finance benchmarking report, 1995-2009*. Stow-on-the-Wold: Infrastructure Economics.
- Flyvbjerg, B. and M.S. Holm (2003). How common and how large are cost overruns in transport infrastructure projects? *Transport Reviews*.
- Flyvbjerg, B., M. S. Holm and S. L. Buhl (2002). Underestimating Costs in Public Works Projects. *Journal of American Planning Association*, 68 (3): 279–295.
- Flyvbjerg, B., M. S. Holm and S. L. Buhl (2004). What Causes Cost Overrun in Transport Infrastructure Projects? *Transport Reviews* 24 (1): 3–18.
- Moody's Analytics (2012). *Default and Recovery Rates for Project Finance Bank Loans, 1983–2010*, Moody's Investors Service.
- Mott MacDonald (2002). *Review of Large Public Procurement in the UK*. Croydon: Mott MacDonald.
- Saunders, A. and L. Allen (2002). *Credit Risk Measurement* Second edition. New York: John Wiley & Sons.

# Avoiding sovereign credit risk exposure in equity portfolios

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The recent sovereign risk crisis in developed countries has reminded equity investors around the globe that, even when not directly holding government bonds, they may be heavily affected by a worsening of sovereign credit risk conditions. For example, it became clear that stocks of companies which benefit from implicit guarantees provided by the government, such as banks, may be affected by news on sovereign risk conditions. Likewise, stocks of companies that benefit from public spending or from tax incentives may suffer in times when public finances worsen. The academic literature actually provides ample evidence that stock returns are indeed sensitive to sovereign risk (see, eg, Belo et al [2011], Gandhi and Lustig [2011], Cutler [1988], Ang and Longstaff [2011], Longstaff et al [2011], Jeanneret [2010] and Hume and Kim [2008]).

An investor might be interested in avoiding such sovereign risk exposure in his equity portfolio for a variety of reasons. For example, a public pension fund has a motivation to avoid sovereign risk exposure in its equity portfolio as the contributions to the fund depend on government funding and beneficiaries' incomes are also sensitive to public finances. Moreover, an investor who is exposed to sovereign credit risk through government bonds may wish to avoid taking too much of the same risk exposure when investing in an equity portfolio.

In this article, we discuss results from recent EDHEC-Risk Institute research on whether it is possible to categorise stocks reliably by their exposure to sovereign risk in order to create equity portfolios with low sovereign risk exposure.<sup>1</sup> We use robust estimation techniques to measure stock return sensitivities to changes in sovereign credit default swap spreads. Our main finding is that such a measurement of sovereign risk exposure of stocks is reliable out-of-sample: in bad times where negative news occurs on sovereign risk conditions, our low sovereign beta portfolios indeed outperform high sovereign beta portfolios. Our approach thus provides a way of identifying which stock portfolios will allow an investor who is already exposed to sovereign risk to avoid loading up on exposure to the same risk factor in his equity investments.

The remainder of the article first explains why and how we proxy for sovereign risk, then provides details on how we measure exposure

to this factor and finally presents out-of-sample performance and characteristics of the portfolios with different levels of sovereign risk beta.

## Measuring sovereign risk: a market-based proxy

In order to measure exposure to sovereign risk conditions, one needs to define a relevant proxy for sovereign risk. Natural candidates one may consider include credit rating agency (CRA) ratings, sovereign bond spreads or CDS spreads. An important consideration is that CRA ratings use accounting and fundamental data and hence are backward-looking, static and contain lagged information. In fact, it has been documented that innovation in sovereign and corporate CDS spreads leads changes in CRA ratings (see, eg, Hull and White [2004], Blanco et al [2005]).

While there is no clear consensus in the academic literature on which measure best represents sovereign default risk, the fact that CDSs reflect current market expectations on the strength of the creditworthiness of sovereign economies is important for our empirical exercise as it will help us better understand the cross-sectional differences in individual stock exposure to sovereign risk under contemporary market conditions. For this reason, we utilise CDSs as a sovereign default risk measure, although further research is warranted to investigate the effect of other credit measures (eg, bond yield spreads) on stock returns. Moreover, our use of CDS spreads means that we do not need to select a risk-free reference, which would be required for the determination of bond spreads.

We look at changes in CDS spreads rather than levels (following Ang et al [2006], Campbell [1996] and Petkova [2006]) because we want to analyse the effect of 'news' about sovereign risk on stock returns. We define a global sovereign

risk factor based on the percentage change in the five-year sovereign CDS spreads of more than 40 countries in our dataset. The risk factor is appropriately signed – ie, a positive value represents good news on the sovereign credit risk front (which corresponds to a reduction in spreads).

Figure 1 plots the World CDS factor from December 2000–December 2011. The figure clearly shows that, in the second half of the analysis, which witnessed the financial crisis and European sovereign debt crisis, the changes in CDS spreads were quite volatile. Weekly values as extreme as +27.36% and –60.42% can be observed in recent times.

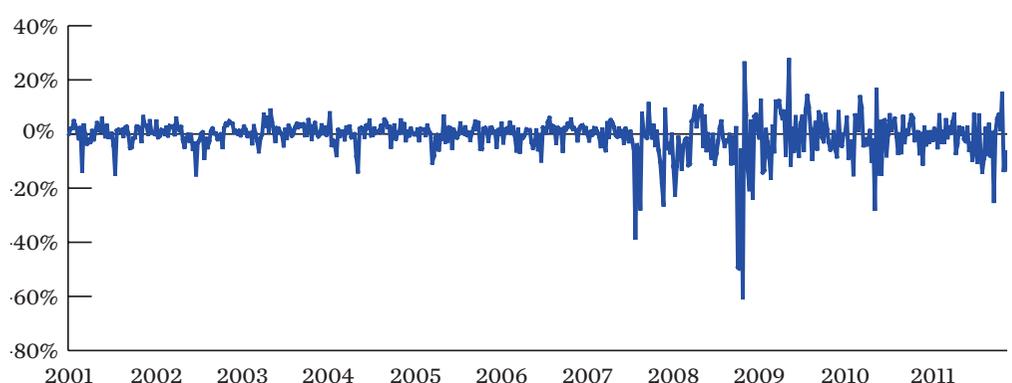
## Constructing low sovereign risk equity portfolios

Global equity portfolios are constructed using all large and mid-cap stocks from developed and emerging economies. An important consideration in our analysis is to obtain robustness. In fact, it has been shown that estimating exposures of individual stocks to risk factors is prone to estimation error and may end up providing unreliable classifications of stocks by their risk exposure (see Ang et al [2012]). We improve the robustness of our approach by mixing data frequencies and by using Bayesian estimation techniques. More precisely, using both daily and weekly frequency<sup>2</sup>, we regress stock returns on the World CDS factor while controlling for the market factor.<sup>3</sup> Using a standard OLS regression of stock returns on risk factor could result in substantial estimation error. A more suitable approach is to use a Bayesian estimation approach (Vasicek [1973]) which optimally combines the stock-level sovereign beta with the sector-level sovereign beta in order to find the best compromise between exploiting stock-level information and avoiding over-fitting the data.

## Results

We look at the differences between low and high sovereign risk stocks at the portfolio level. We form CDS beta sorted decile portfolios with a control for market beta. We focus on the prop- ▶

## 1. World CDS factor returns



<sup>1</sup> See *Managing Sovereign Risk Exposure of Equity Portfolios*, EDHEC-Risk Institute Working Paper, forthcoming.

<sup>2</sup> We average the betas obtained at different frequencies as this has been argued to improve robustness (see, eg, Baesel [1974], Daves et al [2000]).

<sup>3</sup> Our complete stock universe is a global large and mid-cap universe of more than 40 countries and contains more than 2,500 stocks. Returns are obtained from Datastream for the period December 2000–December 2011.

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## 1. World high/low sovereign beta portfolio returns during good/bad news weeks

Good news weeks	High – low sovereign beta
Weekly return difference	0.96%
p-value	0.00%

Bad news weeks	High – low sovereign beta
Weekly return difference	-0.94%
p-value	0.00%

The table shows the differences between the mean weekly returns of the high sovereign beta and low sovereign beta portfolios and their statistical significance over two periods characterised by good news and bad news weeks respectively. All statistics are based on weekly returns from 20 December 2002–16 December 2011.

erties of the first decile (low sovereign beta) portfolio and the tenth decile (high sovereign beta) portfolio. We report the results for only equal weighted portfolios; cap-weighting results in qualitatively similar results.

First, we perform risk-return analysis conditional on sovereign credit risk level by dividing realised portfolio weekly returns over the entire period into five quintiles sorted by World CDS factor. The first quintile is termed Good news weeks and is characterised by high values of the World CDS factor (see the factor construction method). Table 1 shows that the high sovereign beta portfolio out-performs the low sovereign beta portfolio in the Good news weeks regime by 96bps weekly. In the period of Bad news weeks, the low sovereign beta portfolio out-performs the high sovereign beta by 94bps. All the statistics are statistically significant.

Table 2 summarises risk and return statistics of the two decile portfolios and compares them with the benchmark (equal-weighted MSCI ACWI). Over the sample period, the returns of both high and low sovereign beta portfolios are not statistically significantly different from MSCI ACWI returns. Also, the low sovereign beta portfolio has a higher Sharpe ratio than the market index. The low sovereign beta portfolio however displays lower skewness and higher kurtosis than the high sovereign beta portfolio showing that the avoidance of exposure to a specific risk factor did not reduce extreme risks in the distribution of returns.

Lastly, we test if the decile portfolios have hidden biases to risk factors other than sovereign credit risk, and if our results from the conditional analysis could be attributed to any of those biases? We assess, ex-post, some standard characteristics of decile portfolios that account for factor tilts. These are market cap share, average trading volume per share, M/B ratio and dividend yield. Average values of these measures across 36 quarters are reported in table 3. The results confirm that controlling for sovereign risk does not lead to any size, liquidity, or value/growth bias.

## Conclusion

The recent sovereign crisis has made clear that sovereign credit risk conditions have a profound impact on equities. Investors can avoid such risk exposure through a simple stock selection approach that picks low sovereign beta stocks. Our results suggest that a stock's exposure to

## 2. Risk and return statistics for the world portfolios sorted on the World CDS factor

	Low sovereign beta portfolio	High sovereign beta portfolio	High – low sovereign beta	Equal-weighted MSCI ACWI
Weekly mean	0.26%	0.33%	0.08%	0.27%
Weekly standard deviation	2.60%	3.31%	1.29%	2.86%
p-value	71.33%	8.96%	6.80%	–
Annualised mean	12.16%	15.42%	3.62%	12.69%
Annualised standard deviation	18.73%	23.83%	9.28%	20.64%
Sharpe ratio	0.52	0.55	0.14	0.50
Minimum weekly return	-18.3%	-20.5%	-6.2%	-19.8%
Maximum weekly return	9.6%	11.5%	6.0%	12.3%
Skewness	-1.09	-0.84	-0.10	-0.97
Kurtosis	9.21	7.69	5.80	9.82
Tracking error wrt MSCI ACWI	7.0%	5.5%	16.7%	0.0%
Correlation wrt MSCI ACWI	94.2%	97.9%	61.4%	100.0%

The table shows basic performance statistics of high and low sovereign beta portfolios, and MSCI ACWI. All statistics are based on weekly returns from 20 December 2002 –16 December 2011.

## 3. Characteristics of world decile portfolios

	Market cap share	Average trading volume share	Market to book value	Dividend yield
Low sovereign beta	6.73%	8.53%	2.24	2.25
P2: 10–20% sovereign beta	9.99%	8.44%	2.29	2.57
P3: 20–30% sovereign beta	12.52%	9.16%	2.32	2.70
P4: 30–40% sovereign beta	13.47%	10.14%	2.33	2.82
P5: 40–50% sovereign beta	13.62%	11.28%	2.22	2.86
P6: 50–60% sovereign beta	12.77%	10.75%	2.18	2.77
P7: 60–70% sovereign beta	10.42%	10.24%	2.19	2.77
P8: 60–80% sovereign beta	8.43%	10.28%	2.16	2.59
P9: 80–90% sovereign beta	6.91%	9.89%	2.13	2.46
High sovereign beta	5.15%	11.30%	2.12	2.30

The table shows the stock characteristics of decile portfolios of stocks sorted on sovereign beta (while controlling for market beta). All statistics are average values across 36 quarters and are based on beginning of the quarter values from 20 December 2002–16 September 2011.

sovereign risk can be measured reliably by using a suitable proxy for sovereign risk exposure combined with a robust estimation method. We find that portfolios constructed ex-ante with stocks sorted on their past sovereign betas exhibit strong differences in sovereign credit risk hedging properties going forward. During periods of sovereign stress, a low sovereign beta portfolio exhibits better performance than the corresponding market index. At the same time, it does not lead to significantly lower returns overall for the sample period that we studied. In addition, no biases in terms of stock characteristics are found in the sovereign beta sorted portfolios.

### References

- Ang, A., M. Brière and O. Signori (2012). Inflation and Individual Equities, NBER Working Papers 17798, National Bureau of Economic Research, Inc.
- Ang, A. and F. Longstaff (April 2011). *Systemic Sovereign Credit Risk: Lessons from the US and Europe*.
- Ang, A., R. J. Hodrick, Y. Xing and X. Zhang (2006). The Cross-Section of Volatility and Expected Returns. *Journal of Finance* 61 (1): 259–299.
- Baesel, J. B. (1974). On the Assessment of Risk: Some Further Considerations. *Journal of Finance* 29: 1491–1494.
- Belo, F., V. D. Gala and J. Li (2011). *Government Spending, Political Cycles and the Cross Section of Stock Returns*.
- Blanco, R., S. Brennan and I. Marsh (2005). An Empirical Analysis of the Dynamic Relation between Investment-

- Grade Bonds and Credit Default Swaps. *Journal of Finance* 60: 2255–2281.
- Campbell, J. Y. (1996). Understanding Risk and Return. *Journal of Political Economy* 104 (2): 298–345.
- Cutler, D. M. (1988). Tax Reform and the Stock Market: An Asset Price Approach. *American Economic Review*, American Economic Association, 78 (5): 1107–17.
- Daves, P.R., M. C. Ehrhardt and R. A. Kunkel (2000). Estimating Systematic Risk: The Choice of Return Interval and Estimation Period. *Journal of Financial and Strategic Decisions* 13 (1): 7–13.
- Gandhi, P. and H. Lustig (April 2011). *Size Anomalies in U.S. Bank Stock Returns: A Fiscal Explanation*.
- Hooper, V. J., T. P. Hume and S.-J. Kim (2008). Sovereign Rating Changes – Do They Provide New Information for Stock Markets? *Economic Systems* 32 (2): 142–166.
- Hull, J., M. Predescu and A. White (2004). The Relationship between Credit Default Swap Spreads, Bond Yields, and Credit Rating Announcements. *Journal of Banking and Finance* 28: 2789–2811.
- Jeanneret, A. (2010). Sovereign Default Risk and the US Equity Market, working paper, HEC Montreal.
- Longstaff, F. A., J. Pan, L. H. Pedersen and K. J. Singleton (2011). How Sovereign is Sovereign Credit Risk?, *American Economic Journal: Macroeconomics*, forthcoming.
- Petkova, R. (2006). Do the Fama-French Factors Proxy for Innovations in Predictive Variables? *Journal of Finance* 61 (2): 581–612.
- Vasicek, O. (1973). A Note on Using Cross-Sectional Information in Bayesian Estimation of Security Betas. *Journal of Finance* 28: 1233–1239.

# EDHEC-Risk Institute response to the European Commission White Paper, 'An Agenda for Adequate, Safe and Sustainable Pensions'

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On 16 February 2012, the European Commission published a White Paper entitled, 'An Agenda for Adequate, Safe and Sustainable Pensions' (European Commission, 2012, hereafter the White Paper). It points out some of the salient issues facing European countries in the near future, and proposes some European-level responses so as to encourage countries to tackle these issues. In accordance with the subsidiarity principle, many of the reforms need to be enacted at the country level. Nonetheless, the Commission proposes a series of measures at the European level, which revolve around three main aspects:

- **Information and monitoring:** awareness regarding both challenges and best practices, promotion of dialogue between social partners, multilateral monitoring of reforms;
- **Harmonisation and portability:** promotion of a level playing field with Solvency II through the revised IORP Directive, facilitation of cross-border activities through IORP and Portability Directives, possible inclusion of pensions in the scope of Regulation 883/2004/EC on the co-ordination of social security provision, examination of tax and contract law obstacles to cross-border pension investment;
- **Pension design:** codes of good practice for both second- and third-pillar pensions, possible EU certification scheme, optimisation of tax and other incentives, raising quality of third pillar pensions and review of protection against the employer's insolvency.

The information and monitoring side is unlikely to be controversial, but it can be more or less effective depending on how it is enforced. The more complex aspect, but also with potentially the most dramatic consequences, is of course harmonisation. The various legal frameworks may be leveraged to instigate profound changes in national systems, and the European institutions need to thus tread carefully. Finally, pension design raises some good questions, but at this stage, it misses some important elements specific to retirement products by excessively trying to mimic other prudential frameworks.

Recent research conducted at EDHEC-Risk Institute aims to be an in-depth response to the proposals in accordance with past EDHEC-Risk Institute theoretical research, empirical investigations and position papers on regulatory and industry topics. First, we sum up our main focus points on otherwise well-documented concerns regarding pension adequacy and sustainability. Pension systems should better take into account

the needs of current and future retirees, which can only happen through deep structural changes moving the diverse systems towards more hybrid solutions.

Second, we discuss how an effective implementation of the proposals regarding information and awareness can actually push reforms in member states in the right direction. In particular, the multilateral dialogue and negotiations should not exclude the financial industry, which has a major role to play in the reforms.

Third, we review the various legal tools at the EU level and how they should be leveraged – keeping in mind that too much harmonisation can be detrimental, if it leads to oversimplification and ignores the specificities of national systems as well as those of retirement products themselves.

Fourth, we examine those very retirement solutions whose designs barely seem to feature on the European Commission's agenda. While codes of conduct and certification schemes might be beneficial, other elements, notably regarding prudential regulation, as well as the lack of consideration of an asset-liability management approach, might indicate a misunderstanding of some of the singularities of retirement solutions.

Our three key messages are the following.

First, the current pension debate should be used by the Commission to foster increased co-ordination in pension reform. When discussing the sustainability of public finance, one medium-term objective could be to recognise unfunded implicit pension commitments. Second, the prudential framework for pensions is bound to have far-reaching consequences, and it needs to respect the particularities of pension providers, which are not those of insurers. Third, new regulation should encourage the generalisation of asset-liability management practices, both for pension funds and individual retirement products, using the best available knowledge and techniques and evaluating micro as well as macroeconomic impacts.

A move towards hybrid pensions could, with these objectives in mind, provide a more adequate conceptual framework for European countries to converge towards.

## The European Commission needs to ease the co-ordination of national pension reform

The current public debates surrounding pensions on the one hand, and budgetary co-ordi-

nation on the other, would greatly benefit from being held conjunctly. In all logic, unfunded first-pillar public pensions are largely structural problems due to slow-moving demographics, with a large impact on government-sponsored DB schemes and social security pension schemes. Unfunded and underfunded second-pillar pensions also have the potential to weigh on future deficits, as countries may need to eventually bail out some pension plans. The Commission should therefore take advantage of this opportunity and, in the short run, help with citizens' information and push for national reforms. In the longer run, taking into account unfunded implicit pension commitments in the Stability Treaty should, in our view, be envisaged, as it might be the only way to foster coordinated reform across countries.

## A specific prudential framework for pensions

While a prudential framework is certainly needed, it cannot ignore the specific aspects of retirement provisions, in particular when there is a sponsor to provide guarantees. An insurance company could theoretically go bankrupt at any instant and therefore needs short-term prudential rules such as the solvency capital requirement. Pension funds, on the other hand, are truly long-term investors with long-term liabilities. While a homogenised framework for pension supervision in Europe is needed, to model it after Solvency II is a mistake. While insurance providers may want to position themselves in a competition with pension providers, it is a misunderstanding of the specificities of pension provision.

## Incentives for asset-liability management

In our view, the Commission should keep in mind that the constitution of any prudential framework needs to go hand in hand with the design of better retirement solutions. It is pointless and wasteful to apply prudential rules to poorly designed strategies. Current pension fund practices are still largely inadequate, as are the vast majority of third-pillar products. Failing major adjustments, the needs of retirees will not be met.

Far from advocating a one-size-fits-all mandatory solution that would be designed by the regulator, we consider it essential that the industry itself takes action. But to do so, it needs to be supported by a regulation that understands the specificity of retirement needs and that will incentivise, not penalise, investment solutions that match those needs.

Currently, many pension solutions are using the wrong asset allocation strategies applied to the wrong building blocks. Often enough, they do not provide any form of risk management, or leave it as an afterthought. However, some better approaches have been proposed and thoroughly tested, notably in the form of asset-liability management. To ensure those

good practices are used, the regulator has a role setting up the right incentives.

In this area, it is possible to increase pensioners' security while also benefiting equity holders by moving towards hybrid solutions, notably through the development of subtler surplus sharing rules. If pensioners are given access to part of the plan surplus, they will be more willing to accept higher level of risk-taking, which is required to reduce the contribution burden of equity holders.

In the context of the debate about maintaining a 'level playing field' with Solvency II it is clear that simplistic short-term constraints will not be beneficial on their own. The welfare cost associated with such a constraint need not be prohibitive, but it requires the implementation of dynamic risk management strategies that are optimal given the constraint. With or without these regulatory constraints, it appears paramount that funds actually implement and use asset-liability management models, and regularly assess their adequacy and resistance to stress.

### Assessing the micro and macroeconomic impacts before acting

Before proposing new frameworks for pen-

sions with such deep-reaching consequences, it seems vital to assess its impact. A translation of a Solvency II-type regulation to the pension fund industry would require a precise evaluation of the microeconomic consequences on the funds themselves. The quantitative impact study launched by EIOPA (2012) should provide some elements in the context of the revision of the IORP Directive, but it seems to mimic the Solvency II approach rather than adapting to the uniqueness of this market.

At the same time, it is also essential to investigate the macroeconomic (so-called 'general equilibrium') effects of any reform. Pension funds are major players in European economies and are bound to become increasingly so, and imposing rules borrowed from another prudential framework should not be taken lightly. Studying, both quantitatively and qualitatively, the overall impact of introducing new rules should be the touchstone of any new regulatory initiative.

A coherent state-of-the-art framework for risk management practices is currently emerging. Rather than imposing an inadequate framework that will likely hamper the development of appropriate pension solutions,

regulation should design and evaluate the best incentives for a much wider adoption of these asset-liability management techniques. After all, they are the only way to reconcile the adequacy, safety and sustainability that the Commission is aiming for.

*This research was drawn from an EDHEC-Risk Publication entitled "Response to the European Commission White Paper: An Agenda for Adequate, Safe and Sustainable Pensions."*

*The full version of the research is available on the EDHEC-Risk Institute website at the following address: [http://www.edhec-risk.com/edhec\\_publications/all\\_publications/RISKReview.2012-10-01.3712](http://www.edhec-risk.com/edhec_publications/all_publications/RISKReview.2012-10-01.3712)*

#### References

- Amenc, N., F. Cocquemas, L. Martellini and S. Sender (2012). *Response to the European Commission White Paper, An Agenda for Adequate, Safe and Sustainable Pensions*. EDHEC-Risk Publication.
- EIOPA (2012). Draft Technical Specifications. QIS of EIOPA's Advice on the Review of the IORP Directive: Consultation Paper (June 15).
- European Commission (2012). *An Agenda for Adequate, Safe and Sustainable Pensions*, White Paper (February).

# Improving risk management in DC and hybrid pension plans

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Most current pension plans still use asset allocation strategies contradicting the best practices set out in the theoretical literature. However, some better approaches have been proposed and thoroughly tested, notably in the form of asset-liability management.

For defined contribution and hybrid funds, the main challenge is precisely to mitigate the fact that, by definition, they do not provide defined benefits. This means setting long-term objectives for the benefits and adopting the management technique that will maximise the probability of reaching them, while ensuring a maximum risk level in the short run. Most current DC retirement solutions are inadequate, as they do not make use of the state-of-the-art risk management concepts.

A modern framework for thinking about pensions is asset-liability management. It relies on three pillars: liability-driven investing (LDI), accounting for consumption objectives; life-cycle investing (LCI), accounting for the temporal horizon; and risk-controlled investing (RCI), accounting for the risk budgets. EDHEC-Risk Institute has developed models based on this framework and shown its appropriateness in a number of papers, most recently in Amenc et al (2012).

Pensions are long-term liabilities, which are dynamic and depend on several time-varying factors. Pension solutions should therefore be designed in order to maximise the likelihood of meeting those liabilities at the horizon. This is the LDI framework.

Furthermore, the horizon of the investor needs to be taken into account formally. As they approach retirement, plan members should be exposed to less risk. The strategy, notably the amount of risk-taking, should be dynamic

depending on the current wealth and future expected performance, and should explicitly consider the investment horizon. This LCI dimension is therefore crucial to meeting the needs of plan members.

This strategy needs to be implemented while managing risk levels: there need to be short-term constraints too, which take into account the existence of a sponsor when there is one. These constraints can either be self-imposed or defined by the regulator. This is the RCI approach.

Adopting a risk management strategy is paramount, whether for individual retirement products or for collective pension vehicles. In both cases, however, the financial industry has been slow on the uptake.

Risk management can actually be viewed as a threefold concept, comprising risk diversification, risk hedging and risk insurance (see for instance Martellini and Milhau [2011]). Risk diversification consists of investing in a variety of assets or asset classes so as to benefit from imperfect correlations between them. It can be done in a more or less sophisticated way; ideally, it should explicitly consider the structure of correlations and set a goal such as maximising the expected Sharpe ratio (ie, the risk-adjusted performance).

Risk hedging comprises, complementarily, strategies aimed at immunising the portfolio against certain given risk factors. The nature of the risks to hedge may explicitly depend on the structure of the fund. For instance, when there is a sponsor, the pension fund might want to hedge against bad health of the sponsor that would coincide with poor fund performance.

Risk insurance, finally, is designed so that the investment objective is met with the great-

est possible probability. It involves explicitly purchasing protection against bad states of the world, and is the component most often left out of pension strategies.

Traditional retirement products invest in the wrong building blocks: in the best case, they allocate wealth between stocks and bonds, or even cash (with a negative real return). They need to embrace the lessons from modern financial theory and think in terms of a performance-seeking portfolio (PSP) versus a liability-hedging portfolio (LHP).

Overall, current pension fund practices are dramatically far from embracing those solutions. Sender (2010), in a survey of pension funds, their advisers, regulators and fund managers, found disappointing adoption rates for the risk management practices previously described, with some geographic variations.

Only 62% of funds surveyed had defined an LHP; only 46% and 41% respectively were using some LDI and RCI techniques. Less than half claimed to model sponsor risk, to manage prudential risk, and only a third to manage accounting risk. Problems also plagued the construction of the PSP, with an average allocation of one-third to equities and only an average of 16% in less liquid assets such as private equity, hedge funds and infrastructure. Evaluation of the PSP was carried out less than once a year in 39% of cases, and a mere 12% used a risk-return measure to assess the performance of the PSP.

Modern and transparent risk management solutions, as described by Amenc et al (2012), are within reach of pension funds. A conceptual move towards a hybrid paradigm might facilitate the transition as well as the incorporation of all of the risks that pensions are exposed to.

### Towards a hybrid paradigm that encompasses all pension risks

Since DB funds put all risks on the sponsor ▶

◀ while DC funds put them on the plan member, moving completely from DB to DC is rather problematic. Transferring risk from sponsors to individuals is too much of a burden: individuals are usually ill-equipped to manage their DC investments properly. Large gains could be found from an all-encompassing professional asset management scheme that would still respect certain individual constraints.

A conceptual shift can facilitate this transition. Sender (2012) explains the goal should be a move towards hybrid models, with less reliance on the sponsors but not a full transfer to individuals either. This framework could accommodate various degrees of risk-sharing within and between generations. It would create new parameters to ensure the sustainability of pensions to the demographic evolutions. The degree of hybridity can be determined as a function of how much investment risk the plan member can take on, as opposed to (final or average) wage and unemployment risks.

Regarding the various risks to which pension funds are exposed (see table 1), hybrid funds can find some middle ground and be a lot more flexible, especially in the future as underlying parameters evolve.

Risk sharing can have both advantages and disadvantages, depending on the implementation. Indeed, it might limit the need to purchase guarantees like individual annuities, which can be expensive, and the fund can instead pool the aggregate longevity risk and rely on longevity swaps for hedging. The gains from using such techniques could be substantial. At the same time, the level of risk sharing needs to be adequately defined so that guarantees, especially regarding longevity risk, do not end up becoming too costly. Costly guarantees may reduce the capacity of funds to take the right investment risks.

Finally, non-financial risks are a matter of particular seriousness for funds. If assets are properly segregated from the companies, there are fewer risks for sponsored plans in the event of a bankruptcy, given the fund is not heavily invested in the sponsor company. Nonetheless, the assets DC funds are invested in are subject to a number of non-financial risks common to the fund management industry, especially when it comes to sub-custody risk, counterparty risk when derivatives are used, or infrastructure and operational risk. For individual products, mis-selling is also a major issue, and protection against it should be ensured. Proper segregation between individual accounts is also crucial when either the management or the infrastructure is collective.

### Recognising the necessity of an integrated approach to asset-liability management

In the discussion surrounding the imposition of Solvency II rules on pension funds, opponents have notably argued that pension funds are a category in their own right. This is in fact the case for institutional reasons, as well as for financial reasons, and both justify the adoption of an integrated asset-liability management approach.

First, pension liabilities are rather stable in time and easier to forecast than life insurance. Plan members are real long-term investors, where what matters is the pay-out at retirement, rather than intermediate performances. It is therefore logical for them to invest in risky assets, so as to benefit from the life-cycle of assets (notably a long-run reversion to the mean), as well as from liquidity premia. Following the optimal allocation to reach the long term objective, while managing levels of short-term risk, is the goal of ALM.

## 1. Risks in DB and DC funds in the accumulation phase

	DB	DC
Investment risk	Borne by sponsor; indirectly, risk may be borne by different cohorts of plan members	Borne by member, but risk can be managed
Longevity risk	Borne by sponsor; indirectly, risk may be borne by different cohorts of plan members	Borne by member. Can be shifted through purchase of annuity (subject to annuity conversion risk)
Wage path risk	Borne by member	Risk reduced because contributions are based on the specific contributions made by, or on behalf of, a member and depend on lifetime earnings
Job tenure risk	Borne by member	Risk reduced due to greater portability of DC pensions
Default risk	Borne by member (unless pension insurance system where the risk and costs are shifted to a third party)	No risk to member (except where pension plant assets are invested in employer stock) No risk of default of pension provider, provided members' assets are segregated and 'kept safe'

Source: Oxera (2008)

Second, there is also much more visibility on the asset side of pensions, as they are immune to risks on the level of fund raising or, conversely, risks of redemption. This leaves the pension funds free to concentrate on long-term rather than short-term objectives.

Third, it is of prime importance to recognise the explicit role of the sponsor when there is one. In most cases, the presence of a sponsor to back a pension plan ensures that payments can be covered even though a plan did not reach its full funding target. The possible presence of a sponsor can provide additional safety against underfunding of the fund, but it then modifies the optimal allocation and needs to be modelled as part of the ALM strategy.

Adapting the ALM paradigm to pension funds with sponsors is not completely trivial. Martellini and Milhau (2011) propose a model to address the joint quantitative analysis of capital structure choices, pension fund allocation decisions and their impact on rational pricing of liability streams. Pensions are then modelled as a defaultable claim issued to workers and pensioners by the sponsor, and thus form part of the capital structure. In a dynamic setting which can include short-term constraints, regulatory or otherwise, they find that RCI strategies allow the fund to capture more of the risk premium, which has a positive effect on equity value, while protecting pensioners.

A modern ALM strategy using the RCI principles described before in the context of a dynamic LDI approach can account for both short-term constraints and the presence of the sponsor.

The recommendations emerging from such an analysis of investment and funding decisions strongly favour a move towards hybrid pension plans. They could help resolve the current conflict of interest between shareholders and plan members: in the context of choosing an investment strategy, risk taking is detrimental to pensioners if they do not have access to the potential surplus of the fund, while shareholders seek the upside to reduce the contributions they will potentially have to make to secure pension payments. Granting plan members part of the upside while still allowing a reduction of the contribution burden would be beneficial to both sides, in the context of a dynamic liability-driven investment strategy.

Martellini, Milhau and Tarelli (2012) tackle the specific problems stemming from the presence of sponsor risks. They examine forms of dynamic ALM that go beyond the simplest strategies, and consider constraints similar to those the regulator (or even the fund itself) could be expected to impose. They explicitly take into account the financial strength of the company, which could create sponsor risk if underfunding becomes too large. They find that dynamic risk-

controlled strategies are effective in aligning incentives of shareholders and pensioners. The former, indeed, may favour more risk-taking than the latter, who do not usually benefit from surpluses. Giving up part of the upside of the strategy to hedge against part of the downside is beneficial to both.

In summary, there is a substantial need to improve investment and risk management strategies in DC and hybrid funds. One cannot go without the other, and the generalisation of modern asset-liability management practices is paramount to managing the investment risks. A general move toward a conceptual framework of hybrid pension could ease this transition, as well as the management of other pension risks (such as longevity, wage path, job tenure and sponsor default risks). Finally, the presence of a sponsor fundamentally changes the optimal strategies. It is therefore indispensable to properly integrate its role by considering integrated asset-liability management frameworks.

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*The full version of the research is available on the EDHEC-Risk Institute website at the following address: [http://www.edhec-risk.com/edhec\\_publications/all\\_publications/RISKReview.2012-11-26.5257](http://www.edhec-risk.com/edhec_publications/all_publications/RISKReview.2012-11-26.5257)*

#### References

- Amenc, N., F. Cocquemas, L. Martellini and S. Sender (2012). *Response to the European Commission White Paper, An Agenda for Adequate, Safe and Sustainable Pensions*, EDHEC-Risk Institute Publication (October).
- Martellini, L. and V. Milhau (2011). *An Integrated Approach to Asset-Liability Management: Capital Structure Choices, Pension Fund Allocation Decisions, and the Rational Pricing of Liability Streams*. EDHEC-Risk Institute Publication (June) produced as part of the BNP Paribas IP research chair on Asset-Liability Management and Institutional Investment Management.
- Martellini, L., V. Milhau and A. Tarelli (2012). *Dynamic Investment Strategies for Corporate Pension Funds in the Presence of Sponsor Risk*. EDHEC-Risk Institute Publication (March) produced as part of the BNP Paribas IP research chair on Asset-Liability Management and Institutional Investment Management.
- Oxera (2008). *Defined-Contribution Pension Schemes: Risks and Advantages for Occupational Retirement Provision*. Report commissioned by EFAMA (January).
- Sender, S. (2010). *EDHEC Survey of the Asset and Liability Management Practices of European Pension Funds*. EDHEC-Risk Institute Publication (June) produced as part of the AXA IM research chair on Regulation and Institutional Investment.
- Sender, S. (2012). *Shifting towards Hybrid Pension Systems: A European Perspective*. EDHEC-Risk Institute Publication (March) produced as part of the AXA IM research chair on Regulation and Institutional Investment.





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