Risk & Reward
Research and investment strategies

Asia's demographic transition: The challenges and opportunities ahead
Poles apart: Investment implications of our real estate market view
Senior Secured Loans: Return potential, short duration, low correlation

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Editorial deadline: 22 October 2012
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Asia's demographic transition: The challenges and opportunities ahead

Many factors can be singled out as contributing to the higher growth rates seen in Asia over the past half century - the adoption of export-led growth models, relative political stability, a highly skilled and educated workforce, and cross-border technology transfer, amongst others. However, another positive contributor to Asia's economic success has been the so-called "demographic dividend" which has resulted from the particular pattern of demographic transition that has taken place in Asia. However, this process is coming or has come to an end throughout much of the region. This may have effects on the pattern of future growth, fiscal sustainability and capital markets. For investors in Asian markets, the changing age profile of the region is likely to be an increasingly important investment theme, creating both challenges and opportunities.

Ageing is a worldwide phenomenon. In 1990, 6.2% of the world population - or 328 million people - were over the age of 65, according to the United Nations Population Division. By 2050, that proportion is estimated to be 16.2% or 1.5 billion. The general ageing of the world's population has to do with what is called the "demographic transition" - the changes in population growth patterns that result from the transition from rural and agrarian societies to predominantly industrialized and urban societies.

There are three stages in the process of demographic transition. In the first stage, there is a rapid increase in the younger population as access to better public health care and nutrition results in lower infant mortality. In Asia's case, this began to take place in the 1950s and 1960s. Then, as fertility rates begin to fall, there is a second stage of demographic change as fewer children are born and the larger birth cohorts come of working age. The increase in the labour force at this stage relative to other segments of the population produces a first demographic dividend - a boost in per capita income growth that results from an increased size in the workforce. In Asia's case, this took place from the 1970s to about 2010, to varying degrees by country. The growth in working age population - alongside favourable policies that made productive use of additional workers - led to significant gains in per capita incomes and savings rates across the region and underpinned much of the Asian economic growth miracle.

Finally, a third stage in transition takes place, as the boom in the working age population comes to a close. Low fertility rates on the one hand, and greater life expectancies on the other, lead to an overall ageing in society. This is already the trend in much of Europe and to a lesser extent the United States and particularly in Japan. But other countries are in transition too. As a result, in 2050 the global population will be much older, with the share of over-65s more than doubling from 1990 (figure 1). Accompanying the growth in the older population will be a global decline in working age population. According to United Nations estimates, the proportion of what is termed working age population (age 15-65) to those over 65 years of age was nearly 10:1 in 1990; by 2050, this ratio is expected to drop to 3:1.

While the first dividend begins to disappear as the population ages, there is also the possibility that countries can benefit from what demographers call a second dividend. It comes out of life-cycle profiles of savings and consumption, suggesting that working-age adults tend to save more than younger or elderly cohorts. Countries with a higher share of working population have a greater capacity to save - and as a consequence, they invest more. If societies prepare for the ageing process by encouraging the accumulation of assets during working years, boosting productivity or delaying retirement, they can lay the groundwork for sustaining high standards of growth even when age structures are no longer favourable.

A snapshot of ageing Asia
While population ageing is a global phenomenon, there are several notable things that are occurring in Asia's case: The first thing to note is that it is happening very quickly. Asia is ageing more quickly

![Figure 1: Population over 65 as percent of total](source)

![Figure 2: Asian population by age group, 1950-2100f](source)
because fertility rates have declined more rapidly, while life expectancy has shot up (figure 2). From 1950 to 2010, for example, Asia saw life expectancy increase from an average of 42 years of age to around 69 years, while the average number of children per women dropped from 5.82 to 2.28, according to the United Nations. The rapid changes in Asia’s demographic profile are the flipside of the restructuring in Asian economies and societies as a whole. Economic development through urbanisation (figure 3) has been a major theme in the Asian growth model and as workers have moved from low productivity agriculture to higher productivity manufacturing and services and from country to city, birth rates have consequently plummeted (figure 4). Social changes (lower marriage rates, higher divorce rates) and government policies (such as China’s one-child policy) have also contributed to falling fertility rates.

The second development to note is that the rapid change is translating into large absolute numbers of the elderly. Take China as an example, which is expected to see the population of over 65 year olds increase to growth over a quarter of total population in 2050 – from merely 7% in 2000. This translates into almost 242m entrants into the over 65-plus category over the next forty years. Finally, ageing is occurring when per capita income levels are relatively low and social stability systems are weak, threatening much of Asia with falling into what is known as the “middle income trap.” Many countries in the region have lifted themselves out of low-income levels by capturing large productivity gains through a reallocation of underemployed labour in rural areas into labour-intensive, low cost manufacturing using technologies developed abroad. However, as countries attain middle income status, workforces grow more slowly and labour costs begin to rise. Delivering continued growth in per capita incomes becomes more difficult. In a recent survey of over 101 economies, the World Bank cites that only 13 economies have risen from middle-income status to high-income status in the past 50 years – among them are Taiwan, Singapore, Hong Kong and Korea. Will the rest of Asia be able to increase per capita income on a sustained basis given an ageing population?

**Differences between countries**

The ageing phenomenon is most concentrated in the highest per capita income regions of Asia - Singapore, Hong Kong, Korea, Taiwan and Japan (figure 5). Life expectancy rates remain amongst the highest in the world, while the fertility rate has fallen below even levels seen in the US and much of Western Europe. The “ageing index” measuring the proportion of the population aged 65 years or older relative to the young (under 15 years of age) population shows that there will be over 350 elderly persons per 100 young persons in these economies, and in some cases, such as Hong Kong, the elderly will outnumber the young population by a ratio of 4:1 given current population trends. This is even more severe than the ageing profile in the United States (figures 5 and 6).

A middle group consists of countries such as Thailand and China, while finally, there is the lower end of the spectrum, where the ageing process is much less pronounced. Indonesia, India and the Philippines (as well as other countries such as Cambodia and Bangladesh) will continue to have relatively high portions of working age and younger age population, relative to the elderly in the next few decades and therefore could continue to enjoy demographic dividends going forward.

China’s ageing population issue is notable for a number of reasons. The ageing population process
is not as severe as in North Asia, but is taking place quickly and will begin to accelerate substantially in the next 10-15 years. China launched its “one child policy” the year it began comprehensive economic reform in 1979. Designed to alleviate the social and economic pressures of a large population, the policy officially restricts urban couples to only one child, with some exemptions for rural couples, ethnic minorities and parents who themselves lack siblings. Official estimates put the “savings” in population at just over 600,000 in 1990 and just under 1 million in 2011. However, the overall decline in fertility rates has led to a dramatic transformation in age structure. In 1979, the year that the programme was launched, there were nearly 7 individuals under the age of 15 to every person over the age of 65, according to UN estimates. In 2010, that proportion had dropped to 2.3:1. By 2050, the proportion of over 65 year olds to under 15 year olds will have gone the other direction entirely to 0.5:1; in other words there will be nearly 2 elderly to every person under the age of 15.

The flipside of the ageing population is a decline in China’s labour force (figure 7), particularly for unskilled labour. China’s growth success in the reform period has been predicated on the marshalling of a huge surplus of underemployed or surplus rural labour – particularly of young workers – into the factories and workshops along the coast. The decline in supply of young workers has already begun to take place, leading to labour supply constraints and contributing to rising wages in industries that rely on unskilled labour. A third issue is the rising number of university graduates (figure 8) relative to the rest of the working age population. In 2011, the number of university graduates reached 6.1 million from just over 600,000 in 1990 and just under 1 million in 2000.

Challenges and opportunities

As China’s population trends suggest, one of the medium term challenges for the region will be the potential drag on growth as demographic dividends disappear. Work done by the demographers at the Asian Development Bank suggests that through 1981-2010, most of the region reaped positive gains in per capita income through demographic change (table 1). Compared to the overall high rates of growth in the region, the demographic impact has not been the major contributor to growth, but it has had a positive effect. In Korea, for example, demographic change raised per capita income growth by 2.1 percentage points in 1981-2010, in a period when overall per capita growth grew by 6.2%. The demographic impact remained positive through 2000, but disappeared by 2010 and is expected to have a negative impact going forward. A similar experience was seen in most of Taiwan, Singapore and Hong Kong. China is likely to see its demographic dividend turn negative in the next 10 years.

With first demographic dividends disappearing and declines in entry-level workers taking place, labour intensive growth policies may no longer be appropriate in many instances. North Asia dealt with its declining competitiveness through relocating manufacturing facilities to China through much of the 1990s and 2000s. China is now facing a similar challenge as the increase in wages and shortages of unskilled labour is already taking place in low-end manufacturing, particularly in the coastal areas of Guangdong and Zhejiang. Outsourcing – either internally to the western regions of China or to other lower wage economies such as Cambodia, Bangladesh or even parts of Africa – is increasingly taking place. Additionally, there has been a concerted effort to move up the value-added manufacturing chain. China’s 12th Five-Year Plan is designed precisely to deal with the changing demographic mix, by encouraging the development of higher value-added manufacturing and strategic industries and the
deepening of the services sector. Not only does this sidestep the declining pool of unskilled labour, but it also offers opportunities for China's increasingly educated workforce. Successful implementation of additional reform is therefore critical to China's longer-term growth path.

By contrast, countries with larger youth cohorts such as India, Indonesia and the Philippines will continue to see a demographic dividend in the coming decades. This demographic windfall partly explains why South-East Asia has seen relatively buoyant growth in the past few years which has been more resilient in the aftermath of the global financial crisis. But whether a country captures the benefits of a demographic dividend will depend in part on policies designed to enhance worker productivity. India enjoys a vast pool of unskilled labour, for example, but stories of labour shortages of semi-skilled and skilled workers are abundant. Likewise, Pakistan is projected to see the biggest growth in working age population between now and 2050 according to UN projections, but whether that will translate into a significant demographic dividend given low literacy rates and educational standards (particularly amongst women), weak spending on infrastructure and continued political instability remains to be seen. Raising basic education standards and improving economic infrastructure in general are therefore important for these economies to continue to reap demographic benefits.

Meanwhile, the realisation of the second dividend in rapidly-ageing population countries will depend on the policies that are adopted in the next few years. Old age support systems in Asia are relatively weak as traditionally the elderly have relied on family transfers in the absence of strong public schemes. Existing systems are likely to come under increasing strain, not only because of the fast-growing size of the elderly population but also as urbanisation and other social changes take place that reduce the scope for family transfers. If countries meet the pressures of ageing by expanding unfunded public transfer programs, asset growth will be reduced, and the second dividend will be diminished. However, if workers are encouraged to save, retire later, and contribute to pension funds and other savings products, population ageing can potentially boost productivity growth and per capita income. Immigration policies could also be quite important in boosting the growth potential by fostering worker mobility from younger, labour-abundant countries to older labour-scarce countries. Hong Kong and Singapore represent successful examples of ageing societies that have coped with labour force changes through relatively liberal immigration policies.

As a result, Asia's fiscal dynamics and resources are likely to be of greater focus going forward. Generally speaking, recurrent spending on social services and transfer programs in Asia has been relatively low and fiscal balances have been relatively healthy. The types of difficult budget decisions and often acrimonious public debate that is now taking place in the United States and Europe have largely been avoided up until now. However, in an unusually frank public recognition of the longer-term fiscal challenges, Singapore's Prime Minister Lee Hsien Loong recently remarked that taxes in the republic will need to go up to cope with greater amounts of social spending as the population ages. Negotiating who gets a bigger slice of the fiscal pie and who pays for it may be a more important feature of policymaking for other Asian economies as well in the future.

### Investment implications

The ageing population trend in Asia suggests that the positive contribution to growth that came from demographic structures will be drawing to a close in many of the region's economies. On the positive side, the changing age profile of the region could offer a number of interesting investment opportunities as well.

- **New markets that are continuing to enjoy first demographic dividend benefits could receive increased investor attention over time:** In 2012, the region's best performing stock market has been the Philippines, while the larger ASEAN markets Indonesia, Thailand and Malaysia as a whole have outperformed the broader Asia ex-Japan index in the post-Global Financial Crisis period. As labour costs are rising in China, we are seeing new demographic beneficiaries of cheap labour in economies such as Bangladesh, Cambodia and Myanmar where low-end manufacturing is being relocated - will these markets garner equity investor focus over time?

- **In ageing Asia, investment opportunities are likely to multiply in age-related sectors such as insurance and health care:** Within the region, Japan and South Korea, who are furthest along in the ageing population process, currently spend the most on health care as a percentage of GDP. The World Bank estimates that China could potentially increase its spending on health care by 2-3 percentage points of GDP and spend another 3-4 percentage points of GDP between 2010 and 2030 in order to bring social expenditure in line with other upper middle income countries. As public expenditure in these areas rises, increased demand for ageing-related services is likely to follow.

### Other services sectors could also benefit

- At the other end of the spectrum, demand is also likely to

| Table 1: Estimates of demographic dividends, 1981-2030f (percentage points of growth) |
|----------------------------------------|--------|--------|--------|--------|--------|
|                                       | 1981-  | 1991-  | 2001-  | 2011f- | 2021f- |
|                                       | 1990   | 2000   | 2010   | 2020f  | 2030f  |
| China                                 | 2.1    | 0.6    | 0.7    | 0.2    | -0.8   |
| Hong Kong                             | 1.1    | 0.3    | 0.4    | -0.1   | -2.2   |
| India                                 | 0.4    | 0.6    | 0.7    | 1.0    | 0.5    |
| Indonesia                             | 1.1    | 1.4    | 0.8    | 0.6    | 0.2    |
| Korea                                 | 2.1    | 1.1    | 0.0    | -0.1   | -1.5   |
| Malaysia                              | 1.1    | 0.9    | 1.0    | 0.6    | 0.1    |
| Philippines                           | 0.9    | 0.8    | 0.9    | 0.8    | 0.4    |
| Singapore                             | 1.8    | 0.1    | -0.1   | -1.1   | -2.5   |
| Taiwan                                | 1.1    | 0.7    | 0.5    | -1.7   | -1.5   |
| Thailand                              | 2.5    | 1.5    | 0.5    | 0.1    | -0.9   |

pick up for educational services as the importance of investment in human capital intensifies and families spend more in the education of a smaller number of children. Likewise, leisure and recreational services may also see greater growth going forward as growing numbers of Asian retirees travel abroad or seek recreational outlets at home.

- **Capital market reforms could also get a positive boost:** Again, taking China as an example, there appears to be intensifying focus on developing China’s stock and bond markets to make them an efficient source of long term financing for corporates. Encouraging greater institutional participation in domestic equity markets is a key component of this process. Pension assets in China are very low relative to GDP at 6.2% compared to 107% in the US, 101% in the UK and 55% in Japan, according to CLSA. Allocation to equities remains low, with only 9.9% participation in equity markets through Chinese pension funds compared to 41% in the US, as a result of restrictions on pension fund participation in the stock market (CLSA). There is also increasing recognition of the need to establish pension sustainability, as funding issues remain significant. However, public sector assets in the form of state-owned enterprises are also significant, leading to the possibility of increased public sector disposals in order to fund pension schemes. In addition, the further development of public pension schemes in other Asian markets could also be a source of capital market deepening.

*Annabel Betz, Client Portfolio Director, Invesco Asia-Pacific*
Poles apart – investment implications of our real estate market view

At the recent Invesco Real Estate European Client Conference, famous explorer Sir Ranulph Fiennes outlined ambitious plans for the first winter crossing of the Antarctic continent. This is not an activity that many other 68 year olds would contemplate – for most, a safe and secure retirement would be the ambition. This polarisation in adventurousness mirrors investors’ attitudes to the real estate sector at present. We consider a range of investment strategies.1

According to our analysis, about 70 per cent of the total long-term return from real estate, listed or unlisted, comes from the usually strong, and largely stable, income return component.2 In our view, this unlisted, comes from the usually strong, and largely total long-term return from real estate, listed or unlisted, according to our analysis, about 70 per cent of the present. We consider a range of investment strategies.1

Economic and financial uncertainty is likely to persist

Nevertheless, deleveraging and economic rebalancing following the global financial crisis are far from complete. It seems likely that we may be in this environment for some time. Our base case for real estate is built on a scenario of economic recovery with periodic setbacks. Yet, the risks even to this gloomy outlook remain extremely high, most significantly at present in Europe. Factors such as the fiscal cliff in the US, a potential hard landing in China, heightened geopolitical tensions, urban unrest, rising protectionism, currency volatility, bond market turmoil, to name a few, all have the potential to trigger local, regional, and perhaps, global setbacks. This suggests that while investors might wish to take advantage of the forecast returns from the asset class, the more risk averse may also wish to mitigate downside risk.

Muted real estate supply

Five years of weak economic growth leading to weak underlying demand for real estate and shortages of credit have inhibited new construction in most sectors, in major developed markets. In due course, there will be a supply response - multi-family construction at high levels matching strong demand, especially in residential markets in China and India, is slowing but will likely accelerate again before long.

Nevertheless, for several years construction is likely to remain below long-term trends. As a result, market fundamentals may be sounder than the macro-economic outlook suggests. Where demand is picking up, vacancy rates are likely to fall faster and rental growth may resume earlier than in previous real estate cycles. This suggests that market timing strategies may need to be executed quickly.

Major metros or gateway locations are likely to outperform

Key gateway cities are expected to outperform their national economies in most countries. They are expected to be the focus of job growth and perhaps less vulnerable to job contraction in the event of public sector cuts. Tenants in all sectors are likely to focus on the major metros:

- **Office demand** may be stronger from a more diverse range of tenants in the future (perhaps with less reliance on the financial sector and its service providers in some markets).
- **Retailers** will likely focus solely on dominant locations. Elsewhere, economic uncertainty and competition from the internet will hang over secondary locations.
- **Logistics firms** may concentrate on accessible, economical locations for distribution to the faster growing domestic markets and on locations where infrastructure enhancements will help a market benefit from changing patterns of external trade.
- **Residential demand** will likely be boosted at all levels by migrants (young people in particular tend to move when economic times are tough).
- **Tourist hotels** in some gateways will likely benefit from drawing high spending visitors from emerging markets (e.g. Hong Kong in Asia, London and Paris in Europe, Miami, Los Angeles and New York in the US).

Real estate market polarisation

Perhaps most importantly for real estate investment strategies, risk aversion and the sharper decline of the “best-of-core” yield/cap rates have caused real estate capital markets to bifurcate. This has been exacerbated by differences in the availability of debt. In many places, the spread between market yields/cap rates for prime and secondary properties has never been greater. It is leading to a polarisation in opportunities:

- **Strong investor demand for prime properties in major cities has led to aggressive pricing for the limited product available. The pricing of the best buildings/locations/markets appears high by reference to long-term historic averages (i.e. yields/cap rates are low in many places). However, our analysis suggests pricing may not be out of line with long-term norms – the current spread over long-term government bond rates is above its long-term average for both Class A or Class B properties in most major markets.**
- **Investor and lender demand is weak for properties with secondary characteristics (due to location, quality or security of income). Debt strategies may continue to offer opportunities. Nowhere has there been a fire sale of assets to date. The speed of***
Market Opportunities

Risk & Reward, Q4/2012

Figure 1: Summary of total return expectations 2013-2015*

- Average total return for country/region
- Shading represents city ranges within country/region

Total return in % p.a.

- United States and Asia represent a 3 year calendar year forecast (2013-2015); Europe represents a 5 year forecast (Q2/12-Q2/17).

Source: Invesco Real Estate forecasts as at September 2012.

Figure 2: Office market pricing considerations

Office market yield/cap rates, government bonds and spreads in selected cities

- Current bond yield
- Current spread
- Long-term average bond yield
- Long-term average spread


workout varies by country, region and city, in part influenced by the local financial and accounting framework. This happened first and fastest in the US. In Asia-Pacific, a more limited range of markets is affected (e.g. Japan and now Chinese development finance). In Europe, banks continue to address non-performing loans slowly but the pace may quicken as they respond to new regulatory requirements.

Where are the opportunities?

By broad region, generally the outlook appears positive. We expect real estate to deliver a strong income return with some growth in each region.

Of course, regional averages mask a more varied outlook at the country, city, sub-market and asset level. We have tried to capture the second element of that granularity in figure 1 by illustrating the range of city-level forecasts within each broad region. In all cases there is a wide range, providing a timely reminder that a bottom up understanding of real estate markets is an essential complement to top down strategies. Both are important.

The details of the opportunities we suggest investors may wish to consider within each region are presented in Invesco Real Estate’s three regional House Views. At a global level, two broad patterns appear to be emerging:

In developed and emerging Asia and the US, the office sector is likely, in our view, to be a strong performer compared to other sectors in the period ahead. Even in Europe, where the retail sector is generally expected to perform relatively better, office markets in a number of cities are also expected to perform quite strongly. The office sector is traditionally a more cyclical sector; global investors may wish to start to favour the cyclical sectors in some gateway cities in some regions.

Total returns in emerging Asia and emerging Europe are expected to outperform the developed world (with the possible exception of the residential sector in Asia) - but it is noteworthy that the margin of anticipated outperformance is not large. This suggests that on a risk-adjusted basis, the forecast performance of the US and developed Asia may be preferred by some more risk-averse investors. Investors diversifying globally may wish to consider tactically favouring some gateway cities in the US and developed Asia.

What about the risks?

Strong investor demand for the best properties, in the best locations, in the best markets, has caused yields/cap rates to be driven down. Assuming that over the long-term each market has individual characteristics that underpin a natural yield/cap rate, it may be reasonable to consider the potential for mean reversion.

Figure 2 suggests that while real estate may appear highly priced in many markets compared to history, it does not seem unreasonably so when considering the spread over the “risk free” rate (local long-term government bonds):

- Yields/cap rates in most markets are below their long-term average (except Sydney and Madrid).
- The current risk-free rate is markedly lower than the long-term average in all markets except for China and Australia.
- The risk premium is higher than the long-term average in all markets except for Shanghai and Madrid.

This may be reassuring for investors, particularly those expecting long-term government bonds to remain low for a time.

Investment strategy consequences

The outlook for real estate appears to be positive over the period 2013-15, with market fundamentals
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expected to improve despite the weakness of the economic recovery – but this outlook is not without risk. As a result, investment strategy opportunities are polarized.

For investors taking the view that the economic recovery may gain more traction in the period ahead, there may also be access to opportunities to manufacture core real estate via value added or opportunistic strategies.

The more risk averse may wish to remain sharply focused on traditional core real estate which, while aggressively priced in many markets, does not seem to be unreasonably priced compared to the limited opportunities in other asset classes to generate the same secure, stable income return.

So whether one is as adventurous as Sir Ranulph Fiennes or not, there is usually a real estate strategy to pursue. Due to the large number of local markets and types of buildings, for institutional investors real estate offers a degree of diversity that few other asset classes can match – and the possibility to build different portfolios to cater for different risk profiles.

Timothy Bellman, Head of Global Research, Invesco Real Estate

Notes

1 The views and opinions in this article are based on Invesco Real Estate's extensive in-house research, analysis and forecasts.
In this paper, we explore low volatility investing which has recently gained popularity as a possible solution to reducing risk without sacrificing return. We also discuss its benefits and challenges, the variations in portfolio construction techniques and our investment approach.

Low volatility investing is an investment style supported by academic evidence¹ that dates back 40 years. It seeks to reduce future total risk (ex ante) and has the potential to deliver comparable or better returns than a related cap-weighted index over a full-market cycle. This is achievable while maintaining full exposure to the equity risk premium in the long run. The basic relationship between risk and reward as put forth in Modern Portfolio Theory historically has held true across asset classes. As investors move up the risk spectrum from Treasury bills to longer-maturity bonds to equities to less liquid alternatives, they typically earn a higher return at higher levels of risk. But the relationship has held up less well within the equity asset class, as higher risk stocks have, on average underperformed lower risk stocks – especially within the large cap developed equity markets.² In addition, there is considerable evidence over the last two decades across global and regional equity markets that investors could have earned higher returns by investing in lower risk stocks.³

The potential benefits to low volatility investing include:

- Reducing risk without sacrificing return
- Generating positive risk-adjusted returns over a market cycle
- Preserving wealth in crisis periods by minimizing drawdowns and losses in tail events
- Increasing asset allocation flexibility by adding strategies that have lower correlation with more traditional, benchmark-centric strategies as well as more equity-based absolute return strategies.
- Additional benefits include highly liquid, transparent, fully invested portfolios that typically do not utilize derivatives or shorting.

Any investor looking to de-risk⁴, preserve wealth, or increase asset allocation flexibility can potentially benefit from allocating part of their risk budget to low beta/low volatility strategies. Investing in low volatility portfolios allows investors to:

- Reduce equity risk to add risk elsewhere (e.g. alternatives, emerging markets, global small cap or frontier markets)
- Compliment their existing equity allocation further by providing uncorrelated sources of return with traditional, benchmark-centric strategies
- Potentially enhance returns by increasing asset allocation flexibility, e.g., substituting a portion of low-yielding bond and passively-managed stock allocation.

We are often asked where low volatility portfolios fit best. Or whether they can be used as a relative return or an absolute return strategy? Low volatility portfolios have the potential to fit into different investor type portfolios. Benchmark sensitive clients can potentially improve their information ratio by pairing low volatility strategies with existing passive, or actively managed equity strategies with higher expected returns, to increase return without significantly increasing tracking error. Absolute return investors focused on improving their Sharpe ratio can combine low volatility portfolios with equity-based absolute return strategies and potentially increase return without significantly increasing total risk or volatility. On average, a low volatility portfolio has a beta of 0.6 to 0.7, which is typically higher than most absolute return strategies, but it can still be used as a liquidity buffer with the bonus of no derivatives for hedging equity exposure or shorting and at significantly lower fees.⁴

As you would suspect, these benefits are accompanied by a few challenges, which may simply require overcoming a change in mindset. In order to manage investment portfolios in volatile markets, investors should consider relaxing their longstanding views about return and risk. First, as previously noted, contrary to popular opinion, higher risk has not been associated with higher return within the equity asset class. Second, a singular focus on risk and return relative to a cap-weighted benchmark may not fully capture a greater opportunity to produce higher risk-adjusted returns. Third, portfolios with lower total risk than a cap-weighted benchmark may be able to achieve similar returns – or better – over time.

The most mentioned challenges are:

- **Benchmarking low volatility portfolios.** There appears to be no standard benchmark for active low volatility portfolios despite the existence of published benchmarks by major index providers. A 2011 paper by Blitz and Van Vliet⁵ recommended benchmarking low volatility portfolios to a capitalisation weighted market index using a risk-adjusted performance metric such as a Sharpe ratio. They concluded that this approach recognizes that low volatility investing is not primarily aimed at beating a certain low volatility index, but at establishing a risk/return profile favourable to a passive investment in the capitalization-weighted index.

- **Lagging performance in rapidly rising markets.** Typically, these portfolios lag at the inception of a market inflection point and then slowly recover. Generally, they go on to capture the return opportunity, especially during the inevitable market retreat that usually occurs during these cycles. This is especially true of actively managed approaches. However, up market cycles tend to last 3 to 5 years, which can be challenging for a
low volatility portfolio with a lower than market beta exposure, especially for benchmark centric investors.

**Higher tracking error portfolios.** Most investors are historically accustomed to lower tracking error portfolios, especially within larger-cap developed markets. In our experience, the realized tracking error on our low volatility portfolios has typically averaged 7% to 8%. From our perspective, the tracking error on one component of investor’s entire portfolio is likely to be less important than the tracking error of the entire equity allocation because the combination of uncorrelated portfolios should reduce risk.

**Smaller market-cap, deeper value, and larger sector/industry biases.** Most low volatility portfolios have a smaller average market cap than larger cap-weighted benchmarks and this size exposure has historically been a key contributor to excess return. Low-volatility portfolios are also more likely to be value oriented because most value stocks tend to have lower risk. However, in our research and actual experience, this value exposure varies with the market environment, becoming expensive during down economic cycles and more attractively priced during improving to strong market cycles. Lastly, low volatility portfolios tend to have larger, time varying exposures to certain sectors. Typically, the exposures to lower risk sectors such as utilities, consumer staples, and health care tend to increase during periods of economic stress or market uncertainty. Conversely, during periods of economic prosperity, exposures to more highly volatile sectors, such as technology, consumer cyclicals, and financials tends to be higher.

**Sustainability of the premium from low volatility investing.** Despite academic evidence that dates back 40 years and 20+ years of practical evidence that demonstrates the existence of the low volatility anomaly, some investors are concerned that it can be arbitrated away. In our view, the low volatility anomaly is sustainable because it can be explained by the way investors generally behave. Both investor psychology and limited arbitrage opportunities are key to understanding why this anomaly exists and why. This behaviour likely will not go away.

Despite these challenges, many different varieties of low volatility portfolios have been introduced to investors. Each version shares the goal of reducing total risk; however, portfolio construction techniques differ widely.

Passive low volatility portfolios typically have the single objective of reducing total risk. Some passive portfolios are constructed using an optimizer and a risk model to determine optimal weights. This requires a number of subjective assumptions with regard to the level of total risk as well as sector/industry/style exposures and maximum weight on individual stocks. Expected returns are not included in the optimization process. The MSCI Global Minimum Volatility Index, launched in 2008 as a benchmark for low volatility strategies, and now available as an ETF, is an example of a passive low volatility portfolio.

Other passive approaches use quantitative screening with a single low volatility factor to construct a portfolio of low volatility stocks. For example, the S&P 500 Index is screened based on volatility, and the 100 least volatile stocks then become the constituents of the S&P 500 Low Volatility Index. These strategies are typically utilized by exchange traded funds (ETFs) and some index providers. Another subset of passive low volatility portfolios are risk-weighted strategies. Risk weighted approaches either equally weight stocks in their portfolios or weight stocks based on the inverse of their corresponding volatility. Low volatility strategies constructed without an optimizer do not take into consideration the correlation between stocks, which may result in higher risk than with the purer optimized passively managed approach to building low volatility portfolios. Passively managed low volatility strategies can generally be categorized as “smart beta” strategies, which are simply passive alternatives to a cap-weighted market indexing.

The rise in the passive allocation within large-cap developed equities in recent years has increased investor appetite to diversify beta or market exposure. Passive low beta/low volatility strategies attempt to exploit the low volatility anomaly and also diversify equity market exposure.

Actively managed low volatility portfolios are also constructed with an optimizer, but have the combined objective of maximizing total return while also reducing total risk. Introducing stock return forecasts into the portfolio construction process potentially adds to the expected return but also to the expected risk, relative to a passive alternative; however, this risk is typically lower than a cap-weighted index.

Regardless of the portfolio construction technique, low volatility portfolios have greater potential to reduce risk relative to a comparable market cap-weighted index. They share common characteristics such as a lower portfolio beta, lower total realized risk as measured by standard deviation, and larger, time varying sector exposures. Even with these commonalities, differences in portfolio construction may result in shorter-term return divergences, even though the longer-term goal of volatility reduction is achieved.

**Invesco Global Quantitative Equity’s approach to low volatility investing:** Invesco Global Quantitative Equity began exploring low volatility investing in 2004 and launched global and European strategies in 2005 and a US strategy in 2009. After considerable research, we determined that while a passively managed low volatility portfolio generally accomplished the goal of reducing risk and delivering comparable or better-than-index returns, it was not the best low volatility portfolio we could produce. We concluded that an actively managed low volatility portfolio offered the best opportunity to achieve higher risk adjusted returns over the long-term for our clients.

We systematically create global and regional low-volatility portfolios by combining a group of stocks that collectively minimize total risk. Usually these stocks have share prices that are less volatile and the correlation among portfolio holdings is low. The potential return enhancement comes from 1) using our proprietary Stock Selection Model to identify the
most attractive stocks and 2) relaxing the typical benchmark relative constraints, which creates a wider opportunity set with the freedom to seek the highest level of return for a lower level of risk. Incorporating stock return forecasts and portfolio construction techniques has allowed for market participation without sacrificing returns over the long term. In addition, it has also simultaneously reduced risk and limited capital losses. Our research has also shown that this higher expected return was over and above the traditional sources of return – beta (market exposure), size, value, and momentum.

Further, our experience has demonstrated that our low volatility portfolios have the potential to participate more fully in “up markets” than a comparable passively managed low volatility portfolio. Our research shows that the sustainability of the low-volatility premium is less relevant with our actively managed approach because it is the combination of our proprietary alpha and portfolio construction techniques that has led to the highest potential for long-term returns.

Obviously, actively managed approaches are not guaranteed to produce excess return at all times. These long-only, fully-invested portfolios typically do not use derivatives or leverage to reduce risk.

Our experience in managing low volatility portfolios demonstrates the longer-term potential to add value net of fees at a total risk level that is 20 to 25% lower than a cap-weighted index. For nearly 30 years, we have been managing regional and global strategies. We develop models that seek to forecast returns for over 5,000 stocks globally. Our stock selection models are flexible and are applied successfully across various styles, capitalization ranges, benchmarks, and geographic regions. We use the same flexible portfolio construction methodology in managing our low volatility strategies that we use to manage our other strategies.

Summary
Low volatility investing may be particularly relevant to investors who are seeking higher risk-adjusted returns within their equity allocation while focusing on minimizing loss of principal. It can also provide greater asset allocation flexibility for investors when managing their risk budget. With this increased flexibility, investors could maintain or even increase their allocation to equities, if so desired. Despite the concerns about the associated risk with investing in equities, this highly liquid asset class has been able to provide long-term performance to help investors achieve their return targets and funding obligations.8 This alternative solution, which allows investors the potential to maintain or increase equity exposure without incrementally increasing risk, provides a compelling opportunity, especially in this low return environment.

Donna Wilson, Director Portfolio Management, Global Quantitative Equity, Invesco Global Strategies

Notes
2 See for example the performance of the constituents of the MSCI World Index sorted by volatility level (on an industry-neutral basis within Invesco-defined regions) from Dec 1996 - Sept 2012. Volatility defined as total risk predicted by MSCI Barra. Past performance is not a guarantee of future results.
4 Based on Invesco Global Low Volatility composite, 31 July 2005 to 30 September 2012.
6 Based on Invesco Global Low Volatility composite vs. MSCI World Index, 31 July 2005 to 30 September 2012.
8 For example over the past 20 years ending 30 September 2012, the S&P 500 Index has delivered a total return of 8.3%, outperforming most US high quality bond indexes for the same period. Past performance is not a guarantee of future results.

All material presented is compiled from sources believed to be reliable and current, but accuracy cannot be guaranteed. This is not to be construed as an offer to buy or sell any financial instruments and should not be relied upon as the sole factor in an investment making decision. As with all investments there are associated inherent risks. Please obtain and review all financial material carefully before investing. This does not constitute a recommendation of the suitability of any investment strategy for a particular investor. The opinions expressed are those of the author, based on current market conditions and are subject to change without notice. These opinions may differ from those of other Invesco investment professionals.
Senior Secured Loans: Return potential, short duration, low correlation

High market volatility and low returns on what have traditionally been viewed as relatively secure investments are placing ever more demands on institutional investors. We believe that there are asset allocation alternatives to help face the challenge of the current market conditions and potentially generate a worthwhile net yield over the long term. In this article we illustrate how the attractive features of Senior Secured Loans (SSL) can be exploited to help serve investor’s demands.

Senior Secured Loans (SSL) are unlisted loans granted by a syndicate of banks and institutional lenders offering companies access to borrowed capital. By tradition they are floating rate loans, the interest rate typically consisting of the reference rate, LIBOR or EURIBOR, and a risk premium. The issuers are mostly rated below investment grade. SSL display special structural features (i.e. loan collateralisation, seniority of investor claims, extensive covenants) which make them more secure than any other financing instrument of the same issuer. Below we explain the unique characteristics of this asset class.

Active risk management through extensive collateralisation

Despite lacking investment grade status, SSL have a wide range of features that can reduce the risk of default and strengthen investors’ position relative to all the other investors in the event of insolvency:

- **Sustainable collateral:** Material assets, i.e. all company assets such as real estate, machinery and patents, serve as collateral for SSL.

- **First lien on the company’s assets in the event of a bankruptcy:** SSL investors rank senior to all other investors. In the event of default, the loan investors are therefore served first which, compared with high-yield bonds, leads to a far higher recovery rate.

- **Covenants:** Contractually-agreed covenants are a structural feature of SSL. They define the limits within which the issuers can manoeuvre and thus reduce the risk of loss of principal.

- **Permanent controls through the lenders:** Rigorous monitoring of the financial situation, the ability to meet the principal repayments and of the adherence to the covenants using public and non-public information, allows the creditors to intervene at short notice.

Past recovery rates provide insight into how well the default limiting features have functioned. For a meaningful comparison we have chosen high yield bonds since they too have below investment-grade ratings: in the past 25 years, the final recovery rate of SSL has panned out at an average 80.3% compared with that of high yield bonds at only an average 48.5%.

**Hedging against rising interest rates and inflation**

Probably the most difficult task of any investor at the moment is to forecast how market interest rates are likely to develop in the future. The fact, however, that negative nominal interest rates are extremely rare creates a degree of asymmetry which raises the likelihood of interest rates rising rather than falling.

Given the historically low interest rates and concerted actions of the central banks, we believe the following two scenarios are most likely to come about, based on current assessments:

- **Scenario 1: Medium to long-term stagnating interest rates.** If interest rates remain constant, the very attractive current yield compared with other debt investments shows SSL to be an attractive investment.

- **Scenario 2: Medium to long-term rising interest rates.** Owing to the quarterly adjustment of the coupon to the reference rate, SSL participate directly in rising interest rates. At the same time, their short duration of an average 45-60 days also helps mitigate price risk. The combination of floating interest rate and short duration acts as a natural hedge against rising interest rates and inflation.

The phase of rising interest rates in the USA from June 2004 to June 2006 shows that this combination can indeed function as a natural hedge against rising interest rates. When the US Federal Reserve increased the Federal Funds Rate 17 times by a total of 625 basis points, the effective interest rate on SSL increased only by 170 basis points over the same period.

### Table 1: Yields in comparison

<table>
<thead>
<tr>
<th>Index</th>
<th>Universe</th>
<th>Rating</th>
<th>Interest rate</th>
<th>Modified duration</th>
<th>Yield to maturity</th>
</tr>
</thead>
<tbody>
<tr>
<td>S&amp;P Leveraged Loan Index</td>
<td>S&amp;P European Leveraged Loan Index</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barclays Euro Aggregate Government 500MM TR</td>
<td>Europe</td>
<td>IG</td>
<td>fixed-rate</td>
<td>45-60 days</td>
<td>EURIBOR +250 bps</td>
</tr>
<tr>
<td>Barclays Euro Aggregate Corporate 500MM TR</td>
<td>Europe</td>
<td>IG</td>
<td>fixed-rate</td>
<td>45-60 days</td>
<td>EURIBOR +275 bps</td>
</tr>
<tr>
<td>BofAML Euro High Yield TR</td>
<td>Europe</td>
<td>IG</td>
<td>fixed-rate</td>
<td>45-60 days</td>
<td>EURIBOR +300 bps</td>
</tr>
<tr>
<td>Barclays US Aggregate Bond TR</td>
<td>US</td>
<td>IG</td>
<td>fixed-rate</td>
<td>45-60 days</td>
<td>EURIBOR +350 bps</td>
</tr>
<tr>
<td>Barclays US Corporate IG TR</td>
<td>US</td>
<td>IG</td>
<td>fixed-rate</td>
<td>45-60 days</td>
<td>EURIBOR +400 bps</td>
</tr>
<tr>
<td>BofAML US High Yield Master II TR</td>
<td>US</td>
<td>non-IG</td>
<td>fixed-rate</td>
<td>45-60 days</td>
<td>EURIBOR +450 bps</td>
</tr>
</tbody>
</table>

Source: Barclays, BofAML, Credit Suisse, as at 30 August 2012. Past performance is not indicative of future performance.
of 425 basis points, the SSL reference index (Credit Suisse Leveraged Loan Index) performed far better than the indices for short and long bonds. A look at the risk parameter ‘volatility’ also confirms that excess return was generated at comparatively lower levels of volatility, leading to an above-average Sharpe ratio for the SSL reference index (table 2).

**Impressive past returns …**

The performance of SSL measured against the Credit Suisse Leveraged Loan Index is impressive (figure 1). Since the launch of the index in January 1992 a positive result has been chalked up every calendar year with one exception; and in approximately 74% of all calendar years, the return exceeded the 4% mark. The only time a negative return was recorded was in the crisis year 2008 which, however, was more than recuperated in the following year.

Two special effects were responsible for the price plunge in 2008: (1) the need for a number of market players to deleverage, i.e. to lower debt and risk in the aftermath of the Lehman insolvency, and (2) a serious overhang stemming from already signed loans that were still on bank balance sheets and which had not yet been syndicated. These two factors combined to create massive selling pressure.

Investors courageous enough to keep up a buy and hold strategy, in spite of the price plunge in 2008, reaped the rewards of their tenacity: from 2008 to 2010, a total of 4.3% p.a. could have been earned with SSL in terms of the Credit Suisse Leveraged Loan Index, despite the default rate of SSL marking a new record high during that period.

**... and high stability**

The analysis of the monthly results of the Credit Suisse Leveraged Loan Index reveals a consistent track record of positive performance. In the past some 21 years, the reference index has notched up positive results in a good 85% of the months, with only very few exceptions (figure 2).

In addition, SSL have not been very volatile. With the exception of the subprime crisis of the years 2007 to 2009, the one-year volatility of the Credit Suisse Leveraged Loan Index for the US has regularly panned out at less than 5% since its inception in January 1992, and was generally also lower than the volatility of the other European and US bond indices (equally for most investment grade and high yield bond indices; figure 3). This can be attributed to the regular adjustment of the SSL basic interest rate to current market rates. If both the market liquidity and the issuer's rating remain unchanged, the impact of a change in interest rates on SSL prices is only marginal.

**Attractive earnings potential**

The current valuations of SSL seem attractive to us, regardless of which valuation method is used (table 3). The spread to maturity method compares the current yield to maturity (taken as a spread relative to the reference interest rate, in this case the LIBOR or EURIBOR) with its historical average. At the end of August 2012, the spread of American SSL came to 556 basis points relative to the past average of 404 basis points – a premium of 152 basis points. In Europe, the premium relative to the past average stood at 178 basis points. For this reason we believe that the SSL market offers very good value at the moment.

| Table 2: Performance of US loan and bond indices at rising market interest rates |
|-----------------------------|-----------------|-----------------|-----------------|-----------------|
|                             | Yield p.a.      | Accumulated yield | Volatility | Sharpe ratio |
| Credit Suisse Leveraged Loan USD | 5.92% | 12.18% | 2.11% | 2.53 |
| BofAML US Corp Master TR USD | 2.96% | 6.01% | 4.61% | -0.04 |
| Barclays 1-3 Yr US Treasury TR USD | 1.86% | 3.76% | 1.38% | -1.07 |
| Barclays 1-5 Yr US Treasury TR USD | 1.76% | 3.55% | 2.05% | -0.87 |
| Barclays US Agg Bond TR USD | 2.99% | 6.06% | 3.64% | -0.05 |
| Barclays US Corp IG TR USD | 2.80% | 5.67% | 4.59% | -0.09 |

With the [premium spread method](#) it is possible to examine whether the SSL market is over or under-valued in terms of the default rates factored into the prices. At the end of August 2012, the spread to maturity of US SSL (556 basis points) implied a default rate of 11.1%. Based on the following observations we consider this to be overstated:

- The all-time high of the actual 12-month default rate amounted to 10.8% in November 2009 as a consequence of the Lehman crisis.
- The current default rate forecast for 2012 is 2.0%.9
- The current 12-month default rate of the US market is 1.2%.10

To compute the fair spread to maturity, the estimated default rate for 2012 of 2% is used instead of the implied default rate. For the US market, this reveals an estimated spread of 374 basis points versus the LIBOR, some 182 basis points below the current spread and indicative of a potentially attractive investment opportunity. The same is true for the European market with an estimated premium spread of 116 basis points.

### Interesting diversification effects

On account of their special features (short duration, high current yield, unique collateralisation features) and the robust performance over several cycles, SSL show only very low correlations with other asset

### Table 3: Valuation of the US loan market

<table>
<thead>
<tr>
<th></th>
<th>Default rate / STM</th>
<th>Average default rate / STM</th>
<th>2012 estimated default rate</th>
<th>30.8.2012 implied default rate</th>
<th>Hypothetical maximum default rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default rate</td>
<td>1.2%</td>
<td>3.6%</td>
<td>2.0%</td>
<td>11.1%</td>
<td>27.8%</td>
</tr>
<tr>
<td>Average recovery rate</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
</tr>
<tr>
<td>Net default rate (in bps)</td>
<td>24</td>
<td>72</td>
<td>40</td>
<td>222</td>
<td>556</td>
</tr>
<tr>
<td>Spread to maturity (STM; in bps)</td>
<td>556</td>
<td>404</td>
<td>374</td>
<td>556</td>
<td>556</td>
</tr>
<tr>
<td>Risk premium / default adjusted spread (in bps)</td>
<td>532</td>
<td>332</td>
<td>334</td>
<td>334</td>
<td>0</td>
</tr>
</tbody>
</table>

### Table 4: Correlation matrix (10 years)

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
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</thead>
<tbody>
<tr>
<td>Credit Suisse Leveraged Loan USD</td>
<td><strong>1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FSE DAX TR EUR</td>
<td>0.44</td>
<td><strong>1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STOXX Europe 600 PR EUR</td>
<td>0.57</td>
<td>0.92</td>
<td><strong>1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S&amp;P 500 NR USD</td>
<td>0.55</td>
<td>0.84</td>
<td>0.87</td>
<td><strong>1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>MSCI World NR USD</td>
<td>0.58</td>
<td>0.84</td>
<td>0.88</td>
<td>0.97</td>
<td><strong>1</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barclays Euro Agg Govt 500MM TR EUR</td>
<td>-0.28</td>
<td>-0.35</td>
<td>-0.28</td>
<td>-0.25</td>
<td>-0.24</td>
<td>1</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Barclays Euro Agg Corp 500MM TR EUR</td>
<td>0.42</td>
<td>0.15</td>
<td>0.28</td>
<td>0.29</td>
<td>0.35</td>
<td>0.57</td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>BofAHL Euro High Yield TR EUR</td>
<td>0.85</td>
<td>0.56</td>
<td>0.68</td>
<td>0.68</td>
<td>0.72</td>
<td>-0.12</td>
<td>0.59</td>
<td><strong>1</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Barclays US Agg Bond TR USD</td>
<td>-0.02</td>
<td>-0.2</td>
<td>-0.16</td>
<td>-0.02</td>
<td>0.02</td>
<td>0.63</td>
<td>0.55</td>
<td>0.1</td>
<td><strong>1</strong></td>
<td></td>
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</tr>
<tr>
<td>Barclays US Corp IG TR USD</td>
<td>0.37</td>
<td>0.09</td>
<td>0.19</td>
<td>0.27</td>
<td>0.34</td>
<td>0.43</td>
<td>0.8</td>
<td>0.51</td>
<td>0.83</td>
<td><strong>1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BofAHL US HY Master II TR USD</td>
<td>0.83</td>
<td>0.55</td>
<td>0.64</td>
<td>0.73</td>
<td>-0.14</td>
<td>0.55</td>
<td>0.9</td>
<td>0.23</td>
<td>0.61</td>
<td>0.1</td>
<td><strong>1</strong></td>
<td></td>
</tr>
<tr>
<td>DJ UBS Commodity PR EUR</td>
<td>0.37</td>
<td>0.15</td>
<td>0.28</td>
<td>0.21</td>
<td>0.25</td>
<td>-0.18</td>
<td>0.16</td>
<td>0.29</td>
<td>-0.12</td>
<td>0.08</td>
<td>0.25</td>
<td><strong>1</strong></td>
</tr>
</tbody>
</table>

Source: Morningstar, monthly data September 2002 through to August 2012, in base currency.
classes. In our opinion, this makes them an attractive component to consider with regard to asset allocation.

A point worth stressing is that the diversification advantages are not limited to the asset class of equities. Rather, interesting diversification gains can also be derived within a pure bond portfolio – regardless of investment universe and credit rating. For example, US SSL showed only very low correlations with European corporate bonds based on the average of the last ten years, and were even negatively correlated with European sovereign debt (table 4). Therefore, the current conditions offer the opportunity to exchange the duration risk which we believe is insufficiently factored into the price of an investment grade bond, for the (compared with the past) attractively valued credit risk of an SSL.

Portfolio risk can also potentially be mitigated by adding SSL to a portfolio otherwise consisting of only high-yield bonds. The risk of a portfolio of 50% US SSL and 50% US high-yield issues was (measured against the volatility of monthly returns) a good 20% lower viewed over a ten year average than that of a pure high yield portfolio (figure 4).

Summing up, the addition of SSL not only has the ability to lower portfolio volatility but can also enable active duration management. For example, in anticipation of rising interest rates, the duration of a bond portfolio can be significantly reduced through the addition of SSL. Such an allocation can cushion against the losses of other fixed income investments and reduce overall portfolio volatility.

**Conclusion**

In the current market conditions, there are few bond investments able to combine an attractive interest return with low duration and moderate volatility. SSL have generally featured these qualities in the past and, at the same time, offered attractive diversification possibilities as a consequence of the low correlation with other asset classes. The advantages would have been reflected at portfolio level, especially through the generally lower volatility.

Nevertheless, like all asset classes, SSLs are not without risks. Leveraged loans may be less liquid than high yield bonds, which is another reason why a diversified loan portfolio is preferable to investing in a limited number of individual credits. Apart from that, there are default risks, albeit given the seniority of the asset class and the high recovery rates in the past, we consider them less severe than those of many other high yielding credit securities. And even though a SSL’s interest rate is adjusted frequently, there is still interest rate risk.

Indeed, with interest rates currently low, the addition of floating rate SSL could mitigate duration risk without diluting portfolio return. This would help hedge portfolios against rising interest rates. Given the high current yields of SSL, which in the US lie a good 152 basis points, and in Europe a good 178 basis points above past averages,

11 this would appear to be a good time to consider gaining exposure to SSL.

**Björn Wolber, CFA, Manager Investment Analysis, Invesco Continental Europe**

**Notes**

1 Senior Secured Loans are also commonly known as ‘leveraged loans’ since their original intention was to provide companies with debt capital for leveraged buyouts.

2 When the text refers to LIBOR and EURIBOR, it is always the 3 months rate.

3 The recovery rate denotes the percentage of the nominal value which investors in non-performing loans receive in the event of a default.

4 Source: Moody’s, Annual Default Study 2012.

5 SSL with floor agreements only proportionally participate in rising market interest rates after the floor has been exceeded.

6 Source: Federal Reserve, as per August 2012.

7 To determine the spread to maturity, we first calculate the discount factor at which the present value of all cash flows still outstanding (i.e. of the coupon payments and the redemption at par) corresponds to the current price. After deducting the reference rate from this factor we derive the spread to maturity. For simplification purposes, the reference rate is assumed to remain constant during the residual maturity.

8 S&P/LSTA Leveraged Loan Index for the USA, S&P European Leveraged Loan Index for Europe. USA: Average from January 1997 to August 2012. Europe: Average from December 2002 to August 2012, excluding the extreme values from October 2008 to March 2009.


11 Cf. footnote 8.
New approaches to portfolio optimisation: Part 7

Investors diversify to prevent their portfolio positions from losing value at the same time. However, the classic diversification measures not only capture the simultaneous losses but also the simultaneous gains. In this article, we present a diversification measure which only records the high losses that occur simultaneously.

A portfolio is considered diversified and less risky when the return covariances of the individual positions remain within limits and the standard deviation of the portfolio returns is correspondingly low. From the perspective of an investor who may only enter into long positions, this definition falls too short because the standard deviation captures price fluctuations independently of their direction, so it is high not only with considerable losses, but also with strong gains. To add to that, the return covariances only correctly reflect the dependencies between the portfolio positions if their returns are jointly normally distributed or follow another joint elliptical distribution. This is rarely the case in practice.

Since only negative returns are a risk for a long-only investor, a risk measure which only covers the dependencies at the lower end of the joint distribution would be more appropriate. Diversification would then mean that only a few portfolio positions would lose value at the same time.

The closely linked concepts of the copula and the tail dependence were already introduced in previous methodology articles. In this article, we show how the tail dependence coefficient can be considered in portfolio design. First, we will present parametric estimators for the tail dependence between the random variables, and then the non-parametric estimators. Using an empirical example, we will then show how optimum portfolios can be designed when only the lower tail dependencies are considered.

Tail dependencies

A measure of dependence between two random variables at the ends of their joint distribution function is the tail dependence coefficient (TDC).\textsuperscript{1} Since, in this article, we assume that an investor may only enter into long positions, the following observations are limited to the left tail of the joint distribution function of the returns, i.e. to the lower tail dependence coefficient.

For this, we consider the distribution function of two random variables $X$ and $Y$:

$$F_{x,y}(x,y) = P(X \leq x, Y \leq y) \text{ for } (x,y) \in \mathbb{R}^2$$

This bivariate distribution function can also be written in relation to a copula $C$:

$$F_{x,y}(x,y) = C(F_X(x), F_Y(y))$$

where $F_X(x)$ and $F_Y(y)$ stand for the marginal distributions of $X$ and $Y$. In the selected bivariate example, a copula is a joint distribution function of the marginal distributions $C = P(U \leq u, V \leq v)$ with $U = F_X(x)$ and $V = F_Y(y)$, which relates the two-dimensional space $[0,1]^2$ to the one-dimensional space $[0,1]$. If the limit exists, the lower tail dependence coefficient is defined as:

$$\lambda_L = \lim_{u \to 0} \frac{C(u, u)}{u}$$

Because it can be interpreted as a conditional probability, it takes a value between 0 and 1, where 0 is achieved in the independence copula and 1 in a co-monotone copula. The lower tail dependence coefficient is also invariant to strictly monotonically transformations of the random variables $(X, Y)$ and only dependent on the used copula, but not on the marginal distributions of the random variables.

The tail dependence coefficient between the two random variables can be determined empirically with a parametric and non-parametric estimation procedure. Thus, when using the Clayton copula, the lower tail dependence coefficient is a function of its parameter $\delta$:

$$\lambda^{\text{Clayton}}_L = 2^{-\frac{1}{\delta}}$$

and can be determined with a parametric estimation procedure.\textsuperscript{2}

But the tail dependencies can also be directly estimated from the data pairs of two random variables, hence from a non-parametric procedure.\textsuperscript{2} Again, we limit ourselves to the lower tail dependence coefficient. The non-parametric estimators for $\lambda_L$ are derived from the empirical copula. In a sample with the size $N$ and the data pairs $(X_1, Y_1), \ldots, (X_N, Y_N)$ with the ranking $X_{(1)} \leq X_{(2)} \leq \ldots \leq X_{(N)}$ and $Y_{(1)} \leq Y_{(2)} \leq \ldots \leq Y_{(N)}$, it is defined as:

$$C_N \left( \frac{i}{N}, \frac{j}{N} \right) = \frac{1}{N^2} \sum_{l=1}^{N} I \left( X_{(l)} \leq X_{(i)} \wedge Y_{(l)} \leq Y_{(j)} \right)$$

with $i, j = 1, \ldots, N$. The indicator function $I$ takes the value one if $X_{(l)} \leq X_{(i)} \wedge Y_{(l)} \leq Y_{(j)}$ is fulfilled; otherwise it is zero. According to the definition, the empirical copula for $i = j = 0$ also takes the value zero.

Three non-parametric estimators

In the literature, three estimators are presented for $\lambda_L$.

The first estimator, $\lambda_L^{(1)}$, is an approximation for the derivative of $\lambda_L^{(0)}(N,k)$ with respect to $u$ using the slope of a secant in the vicinity of $u$. In this case, the probability $u$ is equated with $k/N$:

$$\lambda_L^{(0)}(N,k) = \left[ \frac{k}{N} \right]^{-1} \cdot C_N \left( \frac{k}{N}, \frac{j}{N} \right)$$

With the second estimator, $\lambda_L^{(1)}(N,k)$, the partial derivative is approximated using the slope of a simple regression of the marginal probabilities $i/N$ for $i = 1, \ldots, k$ on the copula values. This estimator is defined as:
The third option is to use a mixed copula, namely a weighted combination of an independence copula and co-monotone copula. The lower tail dependence coefficient is then the weight parameter. This estimator is defined as:

$$\lambda_{k}^{(3)}(N) = \left[ \sum_{i=1}^{N} \frac{1}{N} \right]^{-1} \sum_{i=1}^{N} \frac{1}{N} \left( C_{N} \left( \frac{1}{N} \right) \right)^{2} \sum_{i=1}^{N} \frac{1}{N} \left( \frac{1}{N} \right)^{2}$$

The threshold parameters $k$ for all three estimators are specified. Similarly to the peaks-over-threshold method in the extreme value theory, there must also be a balance here between bias and variance of the estimator. If too low a $k$ were chosen, the estimation of the lower tail dependence would be inaccurate. For larger values of $k$, although the estimation error is smaller, this is at the price of greater distortion of the measured lower dependence. J. Dobrić and F. Schmid (2005) have shown that with $k \sim \sqrt{N}$, all three estimators are consistent and asymptotically undistorted.

**Tail dependence and portfolio design**

Next, we will examine how the estimators for the lower tail dependence can be considered in portfolio design. We show two possibilities.

**MTD instead of MDP**

In the last article of this series, we presented the concept of the “Most Diversified Portfolio” (MDP). The procedure is similar to a low $\beta$ strategy, i.e. the selection of securities, which only track the movements of the benchmark index at a lower rate and therefore not only participate in index losses, but also in index gains, at a lower rate. The $\beta$ coefficient of an individual asset is the ratio of its covariance with the index and the index variance. The numerator thus contains a symmetric dispersion measure, and the covariance only properly reproduces the dependencies between jointly elliptically distributed random variables.

The same two-step method can also be used here. In the first step, the pairwise tail dependencies between the individual assets are determined with one of the three estimators shown above, and compiled in a tail dependence matrix. It is symmetric, similar to a correlation matrix; on the main diagonal, there are only values of 1, as the correlation of an individual asset with itself is 1. In the second step, the weight vector which has thus been determined is rescaled using the individual assets' volatilities.

**Low $\beta$ only in loss phases**

The tail dependencies can also be used for security-selection strategies with a benchmark index. The procedure is similar to a low $\beta$ strategy, i.e. the selection of securities, which only track the movements of the benchmark index at a lower rate and therefore not only participate in index losses, but also in index gains, at a lower rate. The $\beta$ coefficient of an individual asset is the ratio of its covariance with the index and the index variance. The numerator thus contains a symmetric dispersion measure, and the covariance only properly reproduces the dependencies between jointly elliptically distributed random variables.

Tail dependencies instead of the $\beta$ coefficient have two advantages: firstly, no problematic distribution assumption is required; and secondly, the focus is clearly on the loss side. One would therefore give greater weight to individual assets which do not generally have a low correlation with the benchmark index, but especially during loss phases.

**Empirical application**

Here, the concept of a MTD is applied to a global equity portfolio. As in the last article of this series, the analysis is based on the monthly returns of the MSCI performance indices, calculated in euros, for Australia, Brazil, Canada, Germany, Japan, Switzerland, the UK and the US, from January 2003 and December 2009. Again, we have divided the overall time period into two sub-periods as part of a fix-me strategy. The portfolios were optimized on the basis...
of the in-sample period from January 2003 to December 2007 (60 months). For the allocation defined in this way, we determine the performance in the second sub-period (24 months). This design was chosen in order to include the sub-prime crisis, which was unfavourable for equities.

Figure 1 shows, also similarly to the last article, the relative portfolio allocations, with the equally weighted portfolio (EQW) as the benchmark, as lattice diagrams.7 Table 1 indicates which countries have portfolio shares of more than 1% and also shows the standard deviations of the returns for each country, as well as the average tail dependencies and correlations with the other countries. One can see that with the MTD approach, the portfolio mainly comprises six markets (Germany and the UK are missing), and five markets with the global minimum variance portfolio (GMV) and MDP approaches.

The lack of German stocks in the MTD portfolio can be explained by the fact that the tail dependence of Germany with the equally weighted portfolio is hardly smaller than the tail dependence of the US, but the German market has a much larger standard deviation. The largest overweight is Switzerland (by about 27 percentage points, figure 1), since both the average tail dependence with other countries, as well as the standard deviation, is lowest here.

The low standard deviation is also the reason for the overweight of Switzerland (by almost 25 percentage points) in the GMV, while Australia, Brazil and Germany remain virtually unconsidered here. Although the German market is hardly more volatile than the Japanese market (as with Australia and Brazil too), it is more strongly correlated with the equally weighted portfolio.

Similarly, in the MDP, only five markets are represented with more than 1%. Australia, the UK and the US, the markets with the highest average correlation with the other countries, remain unconsidered.

Figure 2 shows the marginal risk contributions of the individual countries. In the EQW, there is no clear concentration of risk; the highest risk contribution comes from Brazil with just under 25%. More pronounced risk bundles, however, can be seen in the other three portfolios. With the MDP approach, Japan and Switzerland have the highest portion of the overall risk, at 31% and 22.5% respectively. The concentration is even greater with the GMV strategy with risk contributions of almost 37% for Switzerland and almost 31% for the UK, so these two countries account for more than two thirds of the overall risk. With the MTD approach, the concentration of risk is lower; about 54% of the standard deviation of returns is attributable to Switzerland and Canada.

Finally, table 2 shows indicators for the different optimisation approaches. By definition the standard deviation risk of the GMV approach is the lowest. The MTD portfolio is only slightly more volatile. The GMV approach would have the lowest risk. But the MDP portfolio is not far behind, while the GMV strategy provides only little diversification. A comparison of the degree of concentration is only partly possible, as the individual approaches contain different numbers of markets.

Based on the portfolio weights thus determined, we calculated the portfolio development in the second sub-period (figure 3). During the bear market until the spring of 2009, the equally weighted portfolio lost the most and the MTD portfolio the least, closely followed by MDP and GMV. As a whole, an investor with the GMV approach would have lost the most, and one with the MTD strategy would have lost the
least (almost 17% and 12.5%). With EQW and MDP, the loss would have been around 15%.

Summary and outlook
For investors who may only enter into long positions, the lower tail dependencies are a more suitable measure of diversification than covariances and correlations - because they only consider the simultaneous occurrence of losses (but not of gains) and, furthermore, do not require problematic distribution assumptions. The advantages of this approach were also confirmed in a simulation study.

In the next methodology article, we will look at a diversification concept which is based on the contributions of individual assets to overall risk. For example, a portfolio could be considered diversified if no individual asset contributes more than a certain percentage to portfolio risk. The portfolio risk could, for example, be measured with the standard deviation, but also with a one-sided risk measure such as the CVaR.

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Notes
1 Overviews can be found in, for example, Coles et al. (1999) and Heffernan (2000).
2 For the sake of completeness, it should be mentioned that there are no tail dependencies with a Gaussian copula, and that although the Student t-copula implies tail dependencies because of its symmetry, the coefficient measures the degree of dependence on both the left and right end of the distribution.
3 An overview is given by, for example, J. Dobrić and F. Schmid (2005); Frahm et al. (2005); Schmidt and Stadtmüller (2006).
5 See Malevergne and Sornette (2008).
6 The tail dependence coefficient should always be supplemented by a (one-sided or two-sided) security-specific measure of risk, since it does not indicate the level of risk of an individual asset.
7 All calculations were made with the free statistical programming environment R 2.15.0 (R Development Core Team, 2010) and the package portfolio (Würtz et al., 2010), FRAPo (Pfaff, 2012), Hmisc (Harrell and et al., 2010), lattice (Sarkar, 2008) and Performance Analytics (Cari and Peterson, 2010).

Bibliography


All analysis shown is based on simulated portfolios.
The strategic liquidity reserve as a crisis provision for companies

The problems in the banking sector are prompting many companies to deal more intensively with the issue of a strategic liquidity reserve. The asset management industry can make a valuable contribution to this discussion.

The financial crisis is compelling the treasurers of many companies to concern themselves more intensively than before with questions of liquidity management. Amid mounting uncertainty over liquidity budgeting, corporate treasurers are faced with a wide number of challenges:

- Overall economic and political uncertainty compounding the difficulties of budgeting for the liquidity requirement
- Exogenous shocks rendering traditional risk considerations obsolete
- Existing financing instruments unable to meet the capital requirement in extreme scenarios
- Changes in the banking landscape demanding a new kind of liquidity management

Ever more companies are, therefore, setting up strategic liquidity reserves. In effect, it seems they are stock piling liquidity above, and beyond, the operative requirement.1

As such this is nothing new. In former times, however, strategic liquidity reserves were mostly confined to the credit lines at banks and were, therefore, carried on the liabilities side of the balance sheet. Nowadays, though, they are frequently not enough: companies’ growing liquidity requirements are having to cope with a dwindling willingness on the part of banks to grant loans, and for many treasuries it is too risky to rely solely on the credit lines of the principle banking partners in times of a banking crisis. A large number of companies are, therefore, holding additional liquidity in their current assets, i.e. are carrying them on the asset side of the balance sheet – a development further fuelled by high cash flows and low bond yields. For these companies, the strategic liquidity reserve now comprises the following components:

- Revolving banking facilities
- Bank deposits
- Investments on the capital market

This development is most evident in sectors characterized by pronounced cycles and short-term fluctuations in demand. But in defensive sectors with high cash flows, fears over the permanent availability of liquid funds are also mounting - and, by extension, the interest in a diversified liquidity reserve. This is because piling up liquidity is more than simply making provisions for a crisis: strategic liquidity allows companies to “buy time” in order to align themselves with new background conditions, and it also enhances their negotiating position vis-à-vis the banks. Rating agencies also give a positive assessment of an adequate liquidity reserve.

What is more, liquidity stockpiling also creates costs which can be interpreted as a kind of ‘insurance premium’. Banks charge companies interest on undrawn loan funds, and if a company issues bonds and the capital raised is invested at an interest rate below the yield upon issue, an expense is created to the amount of the debt-credit spread. Treasurers endeavour to keep costs as low as possible without losing sight of the security and liquidity demands. Adequate management of the liquidity reserve, most notably of its components on the asset side of the balance sheet, has, therefore, become all the more important. A number of methods and instruments from pension fund management can be especially useful for achieving this.

Time-tested instruments from pension fund management

Pension funds traditionally have a long investment horizon. However, in response to the weak investment results during the financial crisis, many continental European pension funds have drastically shortened their investment horizon. The focus is now being placed on loss limitation, with risk-controlled investment strategies becoming more widespread, especially in the German speaking area.

This has resulted in an alignment of the demands on the investment portfolio of a pension fund and the strategic liquidity reserve of a company - no matter what its size or positioning (table 1). The only remaining difference is that the key target for the pension commitments is the attainment of the actuarial interest rate.

The time-tested investment methods for pension fund portfolios are, therefore, also suitable for managing the strategic liquidity reserve. In both cases, the choice is made for liquid and risk-controlled capital market investments, while the operative liquidity will be exclusively invested in bank deposits, short-term sovereign debt and short bond funds (figure 1). A risk budget - albeit slight - does in all events exist for investing the strategic liquidity with its somewhat longer investment horizon.

<table>
<thead>
<tr>
<th>Table 1: Similar demands</th>
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<tbody>
<tr>
<td>Demands on the strategic liquidity reserve</td>
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<tr>
<td>- Capital preservation</td>
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<tr>
<td>- High liquidity</td>
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<tr>
<td>- Diversification of the counterparty risk</td>
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<tr>
<td>- Low volatility</td>
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<tr>
<td>- Global risk management</td>
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<tr>
<td>- Minimisation of the debit-credit spread</td>
</tr>
</tbody>
</table>

Source: Invesco.
Investment solutions for the strategic liquidity reserve

In our view, an investment solution for the strategic liquidity reserve should embrace stable long-term asset allocation and the short-term background conditions (essentially the risk budget).

There is nothing to argue against the broadest possible selection of the investment classes and styles provided the portfolio fulfils the demands set out in table 1. If, though, the objective of investing the strategic liquidity reserve is to generate alpha over a ‘risk-free’ investment, the question of the alpha sources must be dealt with. According to our estimation, there are essentially two such sources:

- **Asset class allocation**: The asset manager divides up the liquidity reserve across various asset classes, factoring in the above-mentioned demands, in such a way as to be able to generate alpha. Both static and dynamic allocation is possible. With static allocation, the portfolio is brought back to the initial allocation at different developments in the asset classes, while with dynamic allocation additional regroupings are made if the expectations alter. A crucial task of the portfolio manager is to manage the volatility and the risk of the portfolio: irrespective of the investment strategy, the risk specifications must be complied with at all times in order to prevent the investor’s risk budget from being overstepped.

- **Stock picking**: The objective here is to generate alpha through active stock picking. There are a wide range of models and strategies for achieving this. Whether an asset manager is successful or not depends on his ability to recognize and exploit market inefficiencies. And here, too, risk management should be an integral component of the strategy.

Not all asset classes will be suitable due to the demands placed on the strategic liquidity reserve. One of the most important criteria, in our opinion, is the liquidity of the financial instruments. The portfolio must be so liquid as to be able to sell it off entirely within the space of one day in an extreme scenario. Furthermore, since the risk budget has to be managed dynamically, the only markets worthy of consideration in most cases are those also offering liquid derivatives (e.g. futures). This enables swift regroupings to be carried out at extremely low costs.

In other strategies, investment categories with illiquidity premiums also signal attractive alpha potential. In our opinion, though, they are unsuitable for liquidity management. Illiquid investment classes can be tempting every now and then, since their volatility appears to be irresistibly low on account of the scant turnover. However, treasurers should especially ensure that the investments can be traded at all times.

If consideration is given to all these points, treasurers can proceed in the following way:

**Step 1: Strategic allocation**

Various methods can be applied here e.g. risk-based strategies for weighting the asset classes. These approaches can prevent a situation in which a single asset class – commonly equities – accounts for the bulk of the risk, so that the portfolio can generate attractive returns in the broadest range of market scenarios.

One approach is to focus on three investment classes: equities, sovereign debt and commodities. When structuring the portfolio, consideration is given to the availability of what, in most cases, is only a very tight risk budget, and in the equities segment, preference is given to less volatile investments. And importantly, consideration is given to the companies’ specific restrictions in addition to other factors such as risk aversion, liquidity and risk premiums. As a general rule, it should be sufficient to adjust the strategic allocation once a year.

**Step 2: Tactical allocation**

Tactical allocation aims to generate higher returns over the strategic allocation by actively reshuffling the various asset classes. Here, too, account should be taken of the limited risk budget. Portfolio risks should only be taken where there is alpha. In practice, therefore, negative equity market estimates lead to portfolio weights of zero. This complies with the desire of many companies for low risk alternatives to bond portfolios.

**Step 3: Portfolio insurance**

Global risk management ensures that the portfolio’s loss potential always remains within the limits of the risk budget to prevent, as far as possible, the defined minimum value from being overstepped. There are a number of models useful for measuring risk. The crucial point, in our opinion, is that risk management is implemented systematically and efficiently and that the risk model takes account of the following crucial features of capital market returns:

- **Yields are not normally distributed**: Extreme yields come about more frequently than is postulated by the normal distribution assumption.

- **Volatilities are not constant and fluctuate strongly**: This is especially important for strong market movements. In market situations of this kind, traditional risk models frequently underestimate the risk.
Correlations are not constant: In extreme phases, an evidently well-diversified portfolio might not be quite so well diversified because many asset classes suddenly head in the same direction.

One risk parameter that can be used is the Expected Shortfall (ES) which is calculated daily using the t-GARCH-Copula estimation model. Compared with traditional methods (e.g. Value at Risk based on the normal distribution assumption), this model allows a more effective risk-adjusted computation to be made of the daily investment ratios since the t-GARCH-Copula-ES responds far more quickly to changes in volatility.

Figure 2 shows the Value at Risk (VaR), computed using traditional methods, to be inferior to the Expected Shortfall computation, especially in the financial crisis of 2008. The large number of cases in which the loss was overstepped is especially striking in the autumn of 2008. By the same token, the risk was overestimated in, for example, 2009 (the VaR forecast was relatively high) although markets were no longer fluctuating as strongly.

The portfolio insurance model shown here differs from the classic Constant Proportion Portfolio Insurance (CPPI) in two respects:

The use of yield forecasts: if an investment class appears to be unattractive (e.g. on account of its valuation) the class is still not invested in even if sufficient risk budget is available.

The response to market changes: once the risks decline, investments can be made again swiftly, enabling the portfolio to partake in market developments.

Summing up, a strategy of this kind must be subject to daily controls and requires a systematic process. Immediate action is required if risk ceilings are reached or overstepped. Committee decisions here are, if anything, damaging. Asset managers, therefore, have an advantage as they are familiar with making systematic allocations and implementations.

Owing to each company having its own specific demands, objectives and risk tolerances, we believe that one or several individual special funds are needed for an optimal realisation. The investment of the funds can be continuously adjusted without delay. In our view, retail investment funds cannot offer the flexibility and reactivity so urgently required by the treasurer.

Conclusion: Time-tested and risk-controlled investment models for the strategic liquidity reserve

The growing need for companies to physically build up reserves of liquidity is urging corporate treasurers to deal more intensively with asset management solutions. We are convinced that risk-controlled investment strategies, which have stood the test of time in pension fund investments, are also able to create value added for the investments of the strategic liquidity reserve. Since, however, there is no solution which can be applied to all companies, we advocate one or several segregated accounts for each company to complement the existing credit lines and bank deposits.

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Notes
1 Some companies do not distinguish between operative and strategic liquidity but instead hold liquidity with various terms:
   - up to approximately 6-12 months: operative liquidity
   - 12 months to several years: operative and/or strategic liquidity

2 Active stock picking is a further possibility.

3 Expected Shortfall (ES): The ES is defined as the expected loss in the event of the Value at Risk being actually overstepped. The parameter is, therefore, the probability-weighted average of all losses which are higher than the Value at Risk.

4 t-GARCH-Copula estimation model: The risk forecast based on this estimation model determines the maximum investment ratios in equities, bonds and commodities on a daily basis. The yields on financial instruments are not normally distributed, with more fat tails evident. Nor are the correlations of the asset classes constant over time. A copula is a function which denotes the correlation between the non-constant correlations and their common probability distribution (t-distribution to take account of the fat tails). The volatilities are not constant over time and extreme yields can be observed in rapid succession (volatility clustering). This is depicted using the GARCH model (Generalized Autoregressive Conditional Heteroskedasticity).

5 Value at Risk (VaR): VaR is the loss which may not be exceeded at a certain probability in a given period of time.
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Data as at 30 September 2012 unless otherwise stated.