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#02

2nd quarter 2014

The US labour market: a non-consensus view

Investing in the emerging markets – with developed market stocks

Liquid alternatives – more than just return potential

Risk & Reward

Research and investment strategies

#02

2nd quarter 2014

Content

European corporate bonds – an issuers' market

Yields and spreads on European corporate bonds have been testing or even breaking historical lows. Supported by a strong tide of demand, new types of debt instrument are being issued and the structures of new bond deals are also shifting – often to the disadvantage of the investor. We believe that in more challenging market conditions, the features of individual bonds can drive greater price variance. This increases the importance of fundamental analysis of these new types of debt and of the particular features of each bond.

Corporate bond markets have rallied a long way from the lows of 2009 and 2011 and yields on both investment grade and non-investment grade bonds in the euro market are near all-time lows (figures 1 and 2). In part, this has been driven by falling bund yields.

Credit spreads, though they have still not reached the low levels seen in the years before the financial crisis, are tight (figures 3 and 4). It appears unrealistic to expect much further tightening from here.

There is support for these valuations. The level of income available from bank deposits and lower risk assets such as money market instruments and short-dated government bonds has plummeted since 2007. This has increased demand for higher-yielding debt assets and this demand is an important factor in the tightening of credit spreads. Current low levels of inflation and the continuing commitment of major central banks to low interest rates support this trend. Furthermore, the default rate is low (figure 5). Even including a number of defaults related to last year's Cypriot banking crisis, the rate remains near pre-2008 levels.

But this chart also shows that the default rate is not a good predictor of yields. In 2000, 2007-8 and in 2011, defaults lagged rising yields as the market began to discount deteriorating credit conditions before they were confirmed by credit defaults. There is an intuitive argument for default rates to lag yields. Strong demand for credit allows corporate treasurers to lengthen the maturity of their debt, reducing the likelihood of default by extending the period to principal repayment and reducing debt-servicing cost. Rising yields discourage such refinancing.

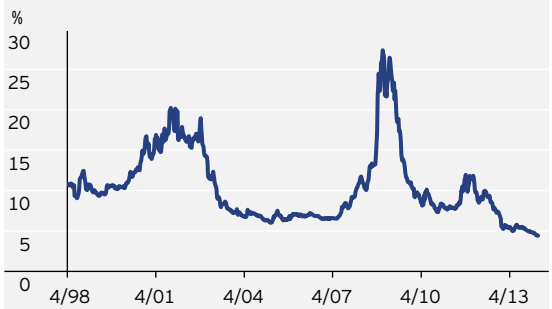
An issuer-friendly market

Current market conditions certainly favour the issuer, in our opinion. New bond deals, many with historically low levels of coupon, are being met with

Figure 1: Euro investment grade bond yields

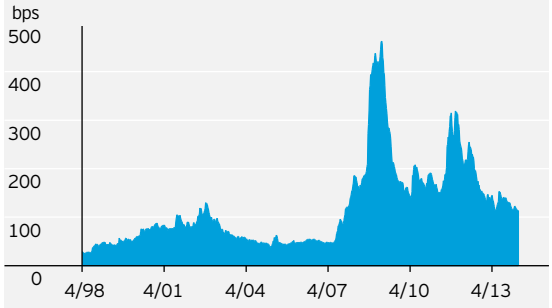
Source: Merrill Lynch. Weekly data as at 21 March 2014.

Figure 2: Euro high yield bond yields



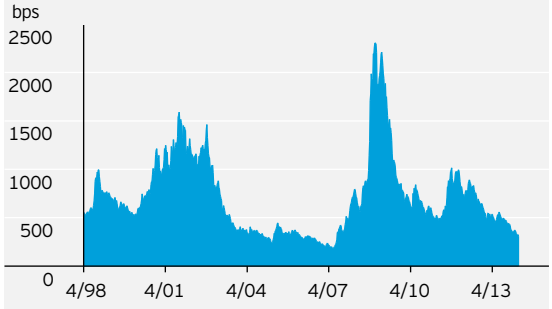
Source: Merrill Lynch. Weekly data as at 21 March 2014.

Figure 3: Euro investment grade bond spread



Spread over Eurozone government bonds (ML EMU Corporate Index).
Source: Merrill Lynch. Weekly data as at 21 March 2014.

Figure 4: Euro high yield bond spread



Spread over Eurozone government bonds (BofA Merrill Lynch Euro High Yield Index – Option Adjusted Spread (v Government)).
Source: Merrill Lynch. Weekly data as at 21 March 2014.

strong demand. Table 1 shows examples of the reduction in coupons on bonds from the same issuer over the past few years.

The reduction of coupon is only one way in which the terms of bond deals are becoming less beneficial for the lender and more advantageous for the borrower. We are seeing some typical cyclical trends developing in the terms of newly issued bonds which are affecting the quality of the market, particularly in high yield.

Call protection (the period between issuance and the first date at which the bond can be called) is falling. The average period from issuance to call in the European high yield market[1] is now 5.0 years[2], compared to 7.9 years in March 2010. The less favourable market conditions of 2008-2010 had seen this measure rise from 5.2 to this peak of 7.9. Although bond holders don't lose when a bond is called, an earlier call date has value as an option for the issuer. If market yields are falling, the issuer can call and refinance at a lower rate of interest, reducing returns for the creditor. If market yields have risen, the bond need not be called.

Other trends in the high yield market include a large rise in the proportion of high yield supply rated B, relative to BB[3] and a rise in the percentage of high yield supply being issued for purposes not normally considered creditor-supportive, such as for leveraged buy-outs and the payment of dividends[4].

Many investment grade issuers have increased issuance of hybrid debt instruments. These securities typically allow the issuer to skip coupon payments without defaulting. A portion of the capital raised is also considered equity by rating agencies, so protecting the issuer's rating.

While these trends can be observed at the market level, bond managers can address them at the security level. Fundamental analysis of new bond issues can take into account all of these particular features of the bond in its valuation.

Bank capital instruments an important factor in supply

Supply has been strong across the bond markets. Current low yields are an incentive to corporate treasurers to borrow – whether to raise new capital or to refinance existing debt. 2013 was a record year for European high yield issuance, with EUR83.3 bn across currencies[5]. Investment grade issuance has begun 2014 strongly and is expected to reach EUR700 bn in the euro and sterling markets combined (figure 6).

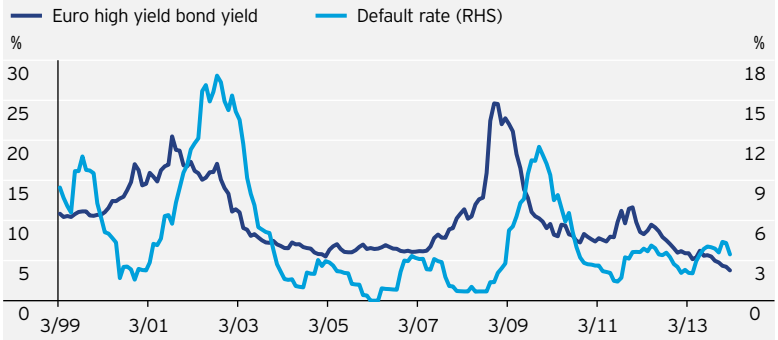
The rise in issuance in recent months has been driven by the financial sector (figure 7). This sector is expected to return to positive net issuance this year after several years of heavily negative net issuance as firms have acted to reduce leverage on their balance sheets since the financial crisis.

This increase in financial sector issuance reflects an important development in the market. The recommendations on the reform and strengthening of bank capital made by the Basel Committee on Banking Supervision in the years following the crisis (known collectively as Basel III) are now being enacted in legislation across Europe and elsewhere. While requirements vary by jurisdiction, with some states legislating for higher capital requirements than set out in Basel III, all require an increase in the amount of capital banks must hold and there is a common definition of the nature of capital instruments which qualify as regulatory capital. The minimum level of Core Tier 1 capital is 6% of risk-weighted assets. There are further requirements for Tier 2 capital and for other, supplementary capital buffers.

New instruments require thorough analysis

Each section of the new capital requirements has specific qualifying criteria. Take, for example

Figure 5: Euro high yield bond yields and the default rate



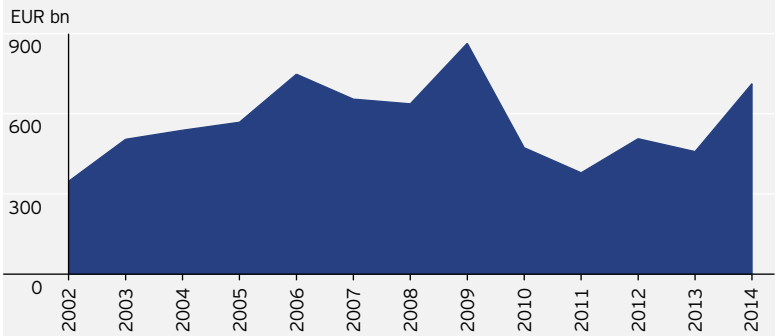
Source: Merrill Lynch, Moody's Trailing 12-Month Speculative Grade Default Rate for Europe. Data as at February 2014.

Table 1: Lower coupons

Issuer	Rating	Issue Date	Tenor (years)	Currency	Coupon (%)
Heineken	BBB+	25/03/09	5	EUR	7.125
Heineken	BBB+	23/01/14	15	EUR	3.500
Coca-Cola	A+	03/03/09	10	USD	4.875
Coca-Cola	A+	29/10/13	10	USD	3.200
BASF	A+	26/06/09	8	EUR	4.625
BASF	A+	13/01/14	10	EUR	2.500
Jaguar Land Rover	BB-	11/05/11	7	USD	7.750
Jaguar Land Rover	BB-	10/12/13	5	USD	4.125

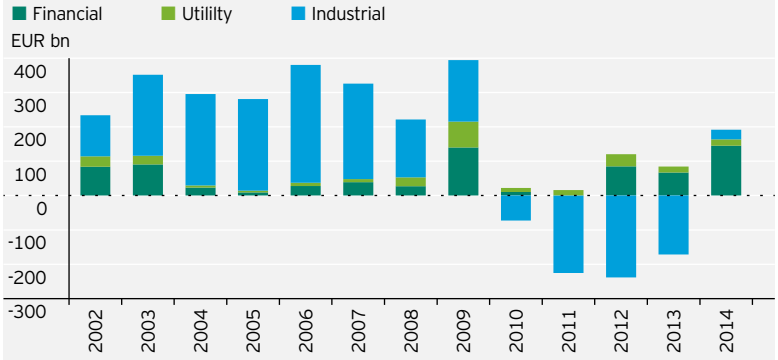
This does not constitute financial advice nor is it a recommendation to buy, hold or sell these securities.
Source: Bloomberg, as at 8 April 2014.

Figure 6: Investment grade bond issuance (EUR and GBP markets)



Source: Barclays. Data as at March 2014 (2014 data is estimated).

Figure 7: Net investment grade bond issuance (EUR and GBP markets), by sector



Source: Barclays, as at March 2014 (2014 data is estimated).

Additional Tier 1 (AT1) capital. This debt can be used to meet 1.5% of the 6% target for Core Tier 1 capital. The coupons on AT1 instruments must be fully discretionary and step-ups in coupon levels (a common feature of pre-Basel III Tier 1 instruments which gave the issuer an incentive to call bonds) are not permitted. AT1 instruments must also be fully loss-absorbing, either through conversion into equity or principal write-down. Debt instruments with this sort of loss-absorbing feature, both debt qualifying as AT1 and other capital categories, are commonly referred to as Contingent Convertibles or CoCos. A number of CoCos have been issued in recent months and it is expected that this trend will continue as banks seek to adapt to the new regulatory environment[6]. Morgan Stanley have recently estimated the European CoCo market could eventually reach EUR250 bn.

This pool of new debt investments is not uniform. These instruments are being issued to meet a variety of capital requirements across a number of jurisdictions with different regulations. These regulations are also new. Each bank is having to work out the best way to reach the goals it has been set. This is leading to a great deal of variety. As Société Générale recently commented: "Standardisation of issuance remains remote in the CoCo market. Despite attempts to raise the consistency of bank capital, national discretion in interpreting the Basel Committee proposals has created non-standardised and non-homogenous CoCo debt instruments. This has led to almost every issuer adding a new aspect to their bonds."

The most important distinctions between these different instruments have to do with the conversion triggers and the treatment of creditors post-trigger. For example, the BBVA 7% Tier 1 instrument issued in February 2014 allows for conversion of the bond to equity in the event that the bank's Common Equity Tier 1 ratio falls below 5.125%. On the other hand, holders of the Credit Suisse 7.5% Tier 1 (issued in December 2013) face a full write-down if Credit Suisse hits that same trigger capital ratio. Further variation comes from the level at which any equity conversion will be enacted and whether the capital ratio trigger is defined under Basel II definitions or Basel III, along with variants of any set of bonds, such as coupon, maturity, call features etc.

These variations, and all the others which exist across the growing universe of "post-crisis" bank capital instruments, create different risks. These risks can be hard to understand but the variety of risks and the particular circumstances of each issuing bank means that this set of instruments cannot easily be valued using a single, formulaic approach.

The valuation of these investments will be decided by the market. At present, most are being well received, with many deals heavily over-subscribed. Rabobank recently estimated that there had been EUR80bn of orders for the EUR8bn of European CoCo issuance in the first quarter of 2014[7]. Over time, as investors become more accustomed to the different risk elements, we think that the price variation will grow. This may be driven by a deterioration in market conditions which could test the likelihood of conversion triggers being reached and the relative benefit of equity conversion to write-down.

Conclusion

At present strong demand is supporting valuations right across the bond market. This is an environment that favours issuers, not investors. Yields are relatively low. The quality of some new issuance is falling while new capital instruments are adding new risks that are not straightforward to assess. We believe that pockets of value remain but we also think that it is sensible in these conditions to build liquidity and not to stretch for yield. The market may well become far more discerning about the valuation of different bonds when this positive tide recedes and investors must be equipped to analyse the fundamental value of each individual bond to find the best fundamental value.

Paul Read, Co-Head of Fixed Interest Team, Invesco Perpetual

Notes:

1 BofA Merrill Lynch European Currency High Yield Index
2 Source: Merrill Lynch, Bloomberg, as at 31 March 2014
3 Source: JP Morgan, Credit Strategy, 8 November 2013
4 Ibid
5 Source: Barclays, January 2014
6 Barclays, Euro/Sterling High Grade Supply Update, March 2014
7 Source: Financial Times, April 2014

The US labour market: a non-consensus view

In this paper, we offer a non-consensus assessment of the US labour market. We believe that the common dichotomy between cyclical and structural influences should be replaced by a construct examining transient and persistent factors. On this basis, we argue that most market participants underestimate US labour market tightness. Therefore, we would not be surprised to see labour-related financial market volatility in the months to come and declining potential GDP growth over the next decade.

Workers are at the core of the macro economy. Labour drives economic formation and long-term appreciation of financial assets. The balance of supply and demand in the labour market is a key focus for monetary and fiscal policies, particularly in the US. Low demand relative to supply can produce high unemployment, strains on government resources and a sluggish or recessionary economy with deflationary price pressure. High demand for labour may put upward pressure on wages and propagate inflation, price instability and economic uncertainty. The US Federal Reserve (Fed) has a mandate to "promote effectively the goals of maximum employment, stable prices and moderate long-term interest rates."[1] Labour is the lynchpin of broad policy – both monetary and fiscal. In the US, it influences matters such as health care reform, immigration and the size and duration of unemployment benefits.

Labour demand ebbs and flows. Spans of rapid growth, low unemployment and rising prices interpose sluggish or recessionary periods. The Fed endeavours to mollify fluctuations and stabilize the economy over time through interest rates. The principal policy rate is the so-called "Fed funds" rate, the overnight rate at which member banks with excess reserves at a Federal Reserve District Bank lend to other member banks. Hiking this rate can reduce credit creation in periods of economic exuberance; lowering this rate can stimulate borrowing, investment, job creation, and growth in periods of weakness.

Growth and inflation typically reach extremes during economic cycles. When metrics on labour and other factors reach levels that point consistently "hot" or "cold," the Fed responds predictably, setting the interest rate dial higher or lower. However, it is the transitions that can be tricky.

We are now in transition. The US economy has emerged from the global financial crisis and the Fed is poised to move away from the "zero interest rate policy" it has maintained for five-plus years. The timing and degree to which the Fed takes its foot off the gas are now principally data-driven – largely, by labour data.

What do labour data tell us? This is the pertinent question. The US unemployment rate has shrunk to a level close to 6.5% – until the March Federal Open Market Committee (FOMC) meeting, this was the key labour threshold identified by the Fed. On the other hand, job creation has been sluggish. As the unemployment rate has fallen, so has the employment rate. In short, supply and demand are moving in the same direction. Where do supply and demand re-equilibrate? How do we interpret this phenomenon and gauge its likely impact on prices of services, goods and financial assets?

Framing responses to these questions requires an understanding of how rates of unemployment and employment can simultaneously shrink. The unemployment rate is the ratio of unemployed workers to the size of the labour force. The employment rate is the ratio of employed workers to the working-age population. The two measures can shrink simultaneously when the labour force participation rate (LFPR) shrinks, that is, when the combined employed and unemployed labour force as a percent of the working-age population declines. In the US, LFPR has been shrinking for more than a decade.

Invesco Fixed Income's research has focused on several key questions surrounding the shrinking LFPR. What is causing this trend? When and where will it end? What does it portend for labour market equilibrium and the "non-accelerating inflation rate of unemployment" (NAIRU)? Are downward drivers of LFPR cyclical or structural?

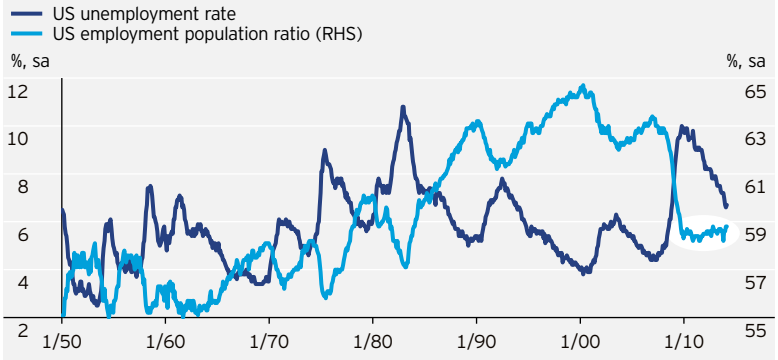
Our research reframes forward views on labour market equilibrium and its potential impact on interest rates and asset prices. We believe the key issue for investors is the persistence of shifts in the labour market. In our view there are significant asymmetries in motives for individuals entering and leaving the labour force. The lack of job prospects in a recession may lead an individual to drop out of the labour force. This is a cyclical phenomenon. However, this individual, while out of the workforce, may follow a path that precludes a return to the labour force even when the recession abates and the job market improves. In this cycle, there has not been a cyclical labour force return for every cyclical exit – that is, there has been a persistent reduction in LFPR.

In our view, there is downward pressure on the LFPR that will keep it from rebounding to the same degree as in other cyclical recoveries. Hence, we believe the unemployment rate will shrink faster than is generally expected. NAIRU, which we estimate at around 5.5%, could be reached in 2014. Consensus opinion sees the economy at NAIRU no earlier than late 2015. Hitting NAIRU sooner than expected could induce inflationary pressure on wages that may impact GDP growth, monetary policy and asset performance. When labour markets reach threshold unemployment levels, financial markets will likely begin to anticipate and "price in" inflation pressures and changes in monetary policy. We believe economic data releases specific to the labour market and inflation indicators will take on heightened importance in the coming months and could lead to increased market volatility.

Labour participation and unemployment

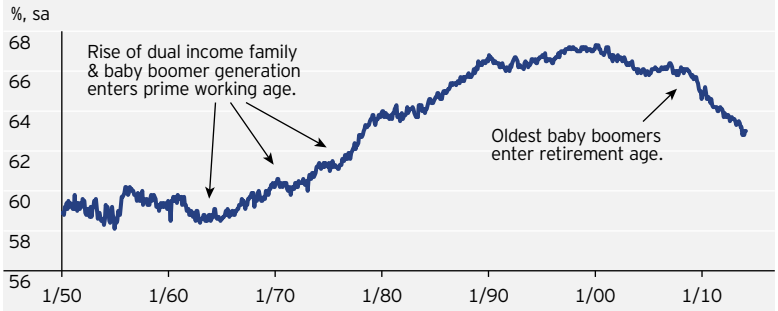
The employment/population ratio and the unemployment rate measure the labour force and the aggregate economic temperature in different ways.

Figure 1: Employment and unemployment no longer move in opposite directions



Sources: US Bureau of Labour Statistics, Bloomberg. Data as at February 2014.

Figure 2: The US labour force participation rate has reflected secular trends



Sources: US Bureau of Labour Statistics, Bloomberg. Data as at February 2014.

In the numerator, the first metric has the number of employed workers and the second has the number of unemployed workers. Workers are either employed or unemployed, so as one metric goes up the other will go down, all else remaining equal. Figure 1 illustrates that changes in these two series were reliably opposed until recently. Since 2009, the unemployment rate has fallen from a 25-year high of 10% to under 7%, but rather than rising, the employment/population rate has flat-lined around 58.5%.

Significantly, the two ratios in question have different denominators. The employment/population ratio (EPR) measures employed workers against the total population. The unemployment rate (UR) measures unemployed workers against the total labour force, a subset of the total population. The breakdown between EPR and UR lies in the relationship between their denominators: the total population and the total labour force. Dividing the size of the labour force by population produces an important metric known as the labour force participation rate (LFPR). Mathematically,

$$EPR = (1 - UR) * LFPR$$

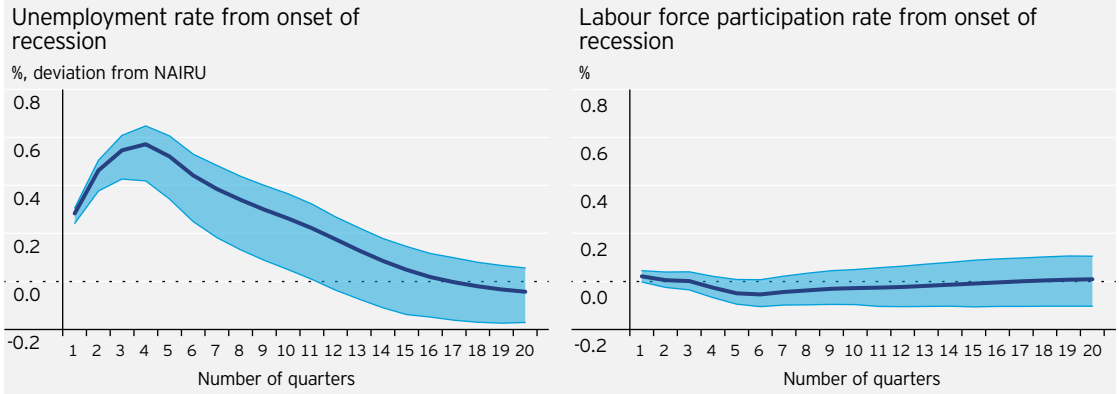
Changes in the employment/population ratio and the unemployment rate exactly cancel one another when LFPR is constant. A non-constant LFPR complicates the matter.

LFPR in the United States grew in the 1970s, '80s, and '90s as steadily more baby boomers and women entered the labour force. It peaked in 2000 and has now declined steadily for more than a decade (figure 2). LFPR exhibits a trajectory more reflective of secular trends in culture and demography than of business cycles and economic vitality. The secular downtrend in LFPR is likely to persist even as economic health returns.

The labour market fluctuates with economic conditions. Figure 3 depicts patterns in unemployment and LFPR from the onset of recession over the years 1949 to 2008. What is notable is that the participation rate when conditioned on the unemployment rate has exhibited much less volatility, moving less than 0.1 percentage points in either direction in the 20 quarters following the onset of a recession. We conclude that the variability in the LFPR due to cyclical factors has been minor.

We further examined the LFPR in this most recent cycle. In 2007, the Bureau of Labour Statistics (BLS) produced an LFPR forecast based on demographics and trend rate economic projections. Figure 4 shows these estimates and the actual LFPR. The great financial crisis likely exacerbated the decline in LFPR, but there has not been a cyclical rebound as growth

Figure 3: The unemployment rate fluctuates much more than the labour force participation rate



Source: IMF, Invesco calculations using an approach similar to Ecreg and Levin, Labour Force Participation and Monetary Policy in the Wake of the Great Recession, 2013. Bivariate vector autoregression was estimated on the unemployment gap (unemployment rate less CBO NAIRU) and labour force participation using data from Federal Reserve Economic Data covering Q4 1949 to Q4 2013.

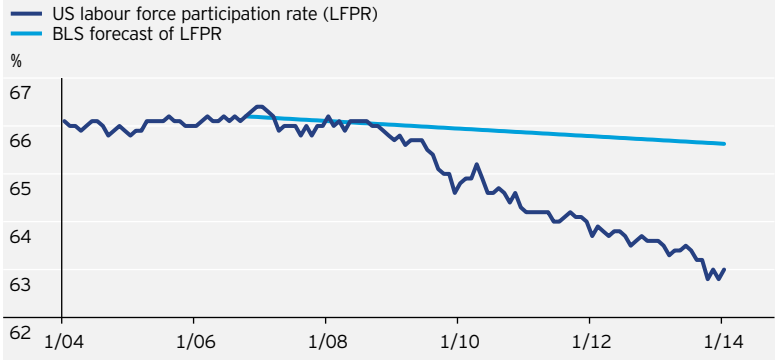
has rebounded. If LFPR explains the anomaly in the relationship between the employment/population ratio and the unemployment rate, and LFPR is cyclical, then one would expect this relationship to renormalize as the economic cycle turns and health is restored. The logic that frames the analysis into structural and cyclical components indicates that the failure of the employment/population ratio to pick up reflects continued ill health in the macro economy and, therefore, the labour force.

Reframing the issue

Can we properly attribute changes in LFPR to cyclical and structural causes? This has been the crux of a large debate. It misses the mark, in our view. There are asymmetries between leaving and re-entering the workforce and between jobs lost and jobs created. For instance, suppose John Doe is a mid-career professional who lost a job due to corporate downsizing in the recession. He was nominally "unemployed" for a time, but eventually gave up and left the labour force. He has been out of work for several years and has adjusted to his new lifestyle. Economic recovery ensues. New jobs exist, but a new job is not John's old job. He likely can't step back into his career at his former role, responsibility, seniority or salary. He has scant motive to start over in an entry-level position, and chooses not return to the labour force. Labour participation is down one man. Is that cyclical or structural? The cause was cyclical. The effect is structural.

Cyclical versus structural is a false dichotomy. It is useful and accurate, in our view, to instead consider transient versus persistent change. Cyclical economic factors conspire with structural factors that may be more "human" than economic. Emigration and disability benefits are further examples. For example, just under 90% of workers who begin collecting disability benefits remain permanently out of the labour force (David Autor and Mark Duggan, National Bureau of Economic Research, August 2006). In figure 5, we categorize several reasons for nonparticipation as transient (less than five years) or persistent (five years or more).

Figure 4: The 2007 BLS forecast of labour force participation rate was missed



Source: US Bureau of Labour Statistics. Data as at January 2014.

LFPR through the transient/persistent lens

How does the 2007 BLS forecast versus actual LFPR look from the "transient versus persistent" perspective? The Philadelphia Federal Reserve surveyed workers who left the labour force between the fourth quarter of 2007 and the end of 2013. LFPR fell 3.2% over this period. By our classification, 0.75% of this decline was due to transient factors, including being discouraged and pursuing additional education, and 2.45% was due to persistent factors (figure 6). Reframing this discussion illustrates further why we believe improved economic conditions may not lead to an increase in the LFPR.

Implications

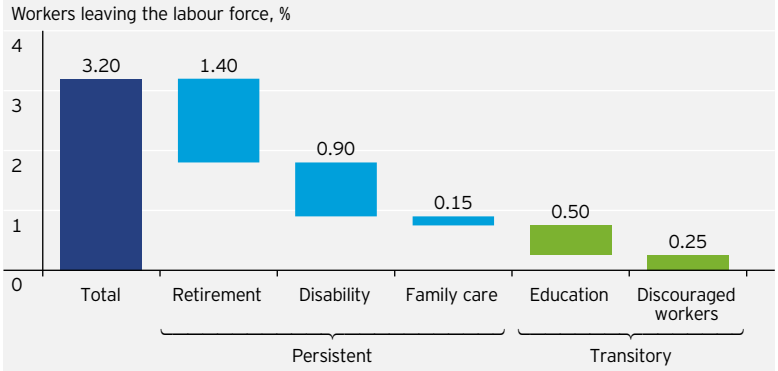
Our findings have clear implications for the unemployment gap, real wages, inflation, and long term GDP growth. We believe that the flat trend in the employment/population ratio is not reflective of a

Figure 5: Transient and persistent rather than cyclical and structural reasons – an alternative concept

Transient nonparticipation	■ Increase in discouraged / marginally attached workforce ■ Workers delaying entry into or temporarily exiting workforce for job training / education ■ Lower workforce mobility due to housing crisis ■ Extension of unemployment benefits
Persistent nonparticipation	■ Acceleration of disability claims ■ Stagnation / reversal of immigration due to home country opportunities and border enforcement ■ Acceleration of retirements ■ Deterioration of jobs skills due to extended length of unemployment ■ Demographics – Aging work force (baby boomers) – Reduction of dual-income households (cost / benefit of second income re-evaluated) – Rise in retirement age due to increase in longevity / changes to Social Security / shift to defined contribution plans from defined benefit plans ■ Mismatch of skills needed versus skills available

Source: Invesco, April 2014.

Figure 6: Most workers who left the labour force from Q4/2007 to Q4/2013 did so for persistent reasons



Source: Shigeru Fujita, Philadelphia Federal Reserve (February 2014), Invesco. Data period from Q4/2007 to Q4/2013.

weak employment market. Rather, it is the result of workforce growth that is materially slower given the lower LFPR. When the cyclical improvement in the labour market subsides, we expect that the employment/population ratio will continue to drift lower.

As such, we believe that the recent rate of unemployment, 6.7% at the end of February, is accurately measuring the labour situation. In our view, there are workers who will leave the labour force now that extended unemployment benefits have been eliminated , driving down both the participation rate and the unemployment rate further. However, we also think that some of these exiting workers will be offset by the return to the workforce of those workers who have been discouraged or who have been pursuing additional educational opportunities.

Our analysis indicates that the unemployment rate may hit our assumed NAIRU of 5.5% during the fourth quarter of 2014 under reasonable assumptions, including our expectation that monthly non-farm payroll growth will be at least the 185,000 average that was achieved in the second half of 2013. Current economic forecasts are for an unemployment rate of 6.2% by the end of 2014 (Bloomberg), consistent with the Fed's forecast. We believe achieving this level ahead of Fed and market consensus clearly has implications for Fed forward guidance regarding policy and the market's response to that guidance.

It will be important, as the labour market tightens, to watch data for indications of increased wage growth. In addition, although there are still many disinflationary forces in effect, we will watch realized inflation and inflation expectations data for signs of upward pressure. The FOMC commented in their statement of 19 March 2014 that "it likely will be appropriate to maintain the current target range for the federal funds rate for a considerable time after the asset purchase program ends, especially if projected inflation continues to run below the Committee's 2 percent longer-run goal, and provided that longer-term inflation expectations remain well anchored". We believe that upward movement in inflation toward the Fed's target of 2 percent will be welcomed, but the challenge will be ensuring such forces remain contained and do not result in sustained increases in inflationary expectations. Markets are aware of the challenge of walking this fine line between enough inflation and too much. How the Fed communicates its forward guidance will face critical scrutiny and has the potential to increase market volatility.

Finally, we expect the ongoing decline in LFPR to be a 0.5% headwind to US potential GDP growth for a decade or more given aging demographics. This is a shift from the 1990s when the increase in LFPR was a 0.5% tailwind to GDP growth and the 1980s when the contribution was greater than 1% (figure 7). In the 1980s, cultural change in the form of increased dual income families was a considerable factor, while both the '80s and '90s were impacted by additional baby boomers entering the work force. While we do not expect a reversal in cultural norms regarding women in the workforce, we do believe the demographic forces that benefitted growth by 0.5% in the 90s will be reversed over at least the next decade, as baby boomers continue to retire. We believe this downward trend in the LFPR is likely to persist until retirements of the baby boom generation level out over the next decade.

Figure 7: Labour force participation to become a headwind for growth

Source: Kevin L. Kliesen, St. Louis Federal Reserve (October 2012). Forecast by Invesco as at February 2014.

Conclusion

In summary, our analysis indicates that the US labour market is tightening. A stagnant employment to population ratio is viewed by many market participants as an indication that considerable slack remains in the labour market, despite the reduction in the unemployment rate. We disagree. We place the analysis of the labour market into a framework that distinguishes persistent from temporary unemployment. Our analysis indicates that aging demographics as well as other influences are leading to a decline in the LFPR. The other influences may, in fact, be brought about by cyclical factors but persist in structural change.

Given this tightening in the labour market, NAIRU may be reached in 2014, in advance of most market participants' expectations. As such, financial markets may begin to anticipate wage pressures and other inflationary forces, "pricing in" these expectations as

well as expectations for changes in monetary policy. Labour and inflation data will be scrutinized by markets, as will Fed forward policy guidance. In this environment, both data and forward guidance will have the potential to generate increased financial market volatility. Finally, given these persistent influences on the labour market, including but not limited to aging demographics, the LFPR is likely to continue to decline for a decade or more, reducing US potential GDP until the time that baby boom retirements subside and cease to offset the increased participation of the echo boom generation.

Ray Janssen, Senior Analyst, Investment Grade Credit Research
Jay Raol, Analyst, Global Quantitative Research
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Note:
1 The Federal Reserve Act of 1977.

New approaches to portfolio optimization: Part 12

In this final part of the series, we show how optimum portfolio allocation can be achieved by means of expected utility maximization. In this case the portfolio weights are treated as random variables. On this basis, we determine the allocation leading to the investor's expected utility.

The starting point of portfolio optimization is the utility function of the investor:

$$(1) \quad U = \lambda\omega\mu - (1-\lambda)\omega'\Sigma\omega$$

with (for N portfolio assets) ω denoting the ($N \times 1$) vector of the portfolio weights, μ the ($N \times 1$) vector of the return expectations, Σ the ($N \times N$) variance-covariance matrix and $\lambda \in (0, 1)$ the risk aversion parameter. The utility maximizing portfolio thus depends on μ, Σ and λ.

In an earlier article in this series we showed that even smaller changes in these parameters can have major consequences for optimum allocation. At that time we proposed resorting to robust estimators or robust optimization methods.[1] In this article we present an alternative.

Unlike before, we now consider the portfolio weights as random variables with a probability distribution. As optimum allocation depends on the returns and risks of the portfolio assets and both are considered as random variables, the weight vector is also a random variable.

Rossi et al. (2002) and Marschinski et al. (2007) take up at this point. They interpret the utility function as the logarithm of a density function whose parameters include the weight vector ω. The optimum allocation is the expected value of ω. That explains why reference is also made to a "probabilistic" interpretation of the utility function.

In the following we make use of the general function $u = u(\omega, U, \theta)$. U denotes the utility function and θ all its arguments (e.g. expected returns, risk factors and/or dispersion measures). The expected utility is proportional to the logarithm of the probability expression:

$$(2) \quad \omega \sim P(\omega|U,\theta) = Z^{-1}(\nu,U,\theta)\exp(\nu u(\omega,U,\theta))$$

In equation (2) Z is a constant so that the area below the density function is normalized to one. This constant is defined as:

$$(3) \quad Z(\nu,U,\theta) = \int_{\mathfrak{D}(\omega)} [d\omega] \exp(\nu u(\omega,U,\theta))$$

Equation (2) also contains the convergence constant ν which is defined as $\nu = pT^{\gamma}$, with T representing the sample range. With $p = 1$ and $\gamma = ½$, an asymptotic convergence to the utility maximizing allocation is derived with the rate $\sqrt{T}$. For $\nu \to \infty$ the distribution converges to the utility maximizing allocation, for $\nu \to 0$ to a portfolio with equal-weighted assets.

With

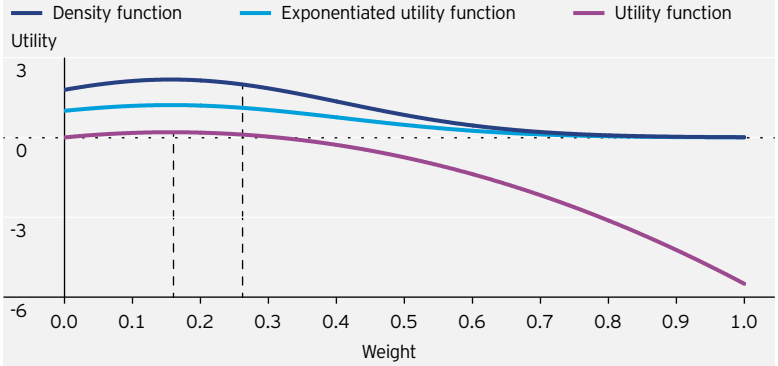
$$(4) \quad \bar{\omega}(U,\theta) = Z^{-1}(\nu,U,\theta) \int_{\mathfrak{D}(\omega)} [d\omega]\, \omega \exp(\nu u(\omega,U,\theta))$$

the portfolio solution ω can then be determined as an expected value.

The precise extent to which the probabilistic interpretation of the utility function differs from the classic utility maximizing allocation is illustrated in the following example. We assume a portfolio with two assets, a risky asset with excess return of 5 percentage points and a standard deviation risk of 4% and a risk-free investment. The risk aversion parameter λ is assumed to be 0.5, the constant ν is assumed to be 1.

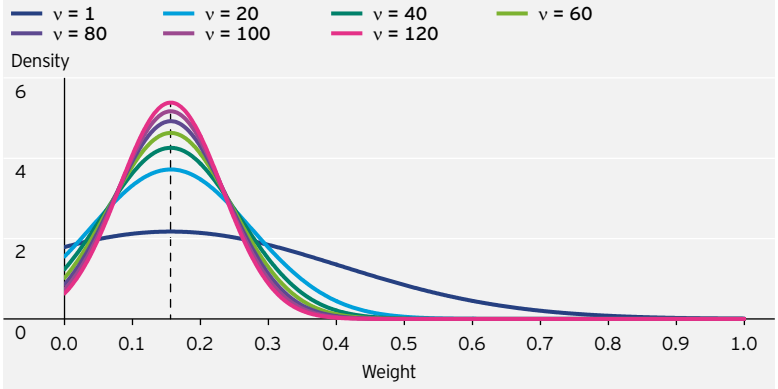
Figure 1 depicts the utility function as a purple line; the utility maximizing share of the risky asset amounts to around 15.6%. The exponentiated utility function is shown as a light blue line, the density function as a dark blue line. The area beneath the exponentiated utility function is unequal to one; it only becomes a valid density function through the normalization constant. Its expected value amounts

Figure 1: Utility maximizing and probabilistic optimum allocation



Source: Invesco, own calculations. For illustrative purposes only.

Figure 2: Asymptotic convergence of the probabilistic utility function



Source: Invesco, own calculations. For illustrative purposes only.

to around 26.7% and is thus greater than that of the utility maximizing allocation. The values of the utility function are 0.2 and 0.1.

In this example, figure 2 illustrates the convergence of the probabilistic utility function to the utility maximizing allocation. The values assumed by constant ν are 1, 20, 40, 60, 80, 100 and 120 ($p = \gamma = 1$). With increasing sample size, the distribution collapses over the utility maximizing allocation.

Determining the distribution function

According to equation (4), the optimum portfolio is an N-dimensional integral multiplied by a constant. Due to the general impracticability of an analytical solution, the distribution function is determined according to the Markov-Chain Monte Carlo model, known as the MCMC model. This involves searching the state space of the distribution parameter and evaluating it along a Markow chain.[2] The only input size required by the MCMC model is a density function as in equation (2). Detailed explanations can be found in Gilks et al. (1995) and Brooks et al. (2011).

The drawback with this standard form of the MCMC model is the generally high auto correlation which greatly slows down the process of searching the entire state space of the distribution parameter due to the many steps required. For this reason, Duane et al. (1987) introduced a version of the MCMC model which not only avoids this weakness but also leads in most cases to a higher acceptance rate for the individual steps. This method is also known as the Hybrid-Monte-Carlo algorithm, or quite simply the HMC algorithm. Compared with the classic MCMC model, (1) the search of the state space is made in larger steps, (2) the autocorrelation is lower and (3) the acceptance rate is higher. The distribution function can therefore be determined more quickly. But the advantages of the HMC algorithm also come at a price: Besides the density function itself, the gradient of its distribution parameter is now also required. Neal (2011) offers a detailed description of the HMC algorithm which is used in the following simulation study.

Simulation

With the concept of the probabilistic utility function we now optimize a mixed portfolio of equities and bonds similar to previous articles in this series. The portfolio comprises generic futures on S&P 500, DAX, FTSE 100 and Nikkei and futures on ten-year sovereign bonds from the US, Germany, the UK and Japan.[3] We used month-end values from October 1998 to September 2013.

Similar to Marschinski et al. (2007), the structure of the analysis is geared to Michaud (1989, 1998):

1. On the basis of the discrete percentage returns, the expected returns and the variance-covariance matrix are calculated (μ, Σ). These estimates are considered as true values of the data pool, assuming that the yields are jointly normally distributed.

2. The utility maximizing allocation is determined on the basis of these true parameters.

3. With the distribution parameters, K random data sets are produced with sample range L.

4. For each of the K data sets (1) the utility maximizing allocation and (2) the expected value of the probabilistic utility function are determined.

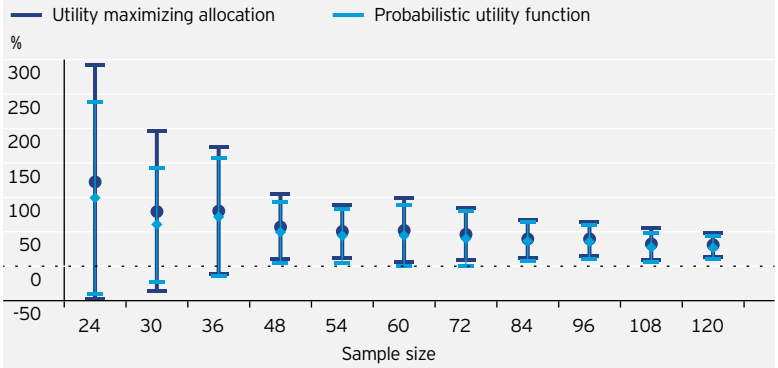
5. Finally, for each data set the deviations ("distances") of the two solutions from the true allocation (in accordance with point 2) are calculated.

For samples with 24, 30, 36, 48, 54, 60, 72, 84, 96, 108 and 120 observations, 100 data sets were generated ($K = 100$). The Markow chain was 250 in length, with the first 150 data sets for the distribution parameters not included in the determination of the expected values ("burn-in periods"). The constant ν was in each case equated with the sample size. The percentage deviations of the utility from the true utility were used as distances.[4]

Figure 3 shows the empirical distribution of these distances, described by mean and standard deviation.

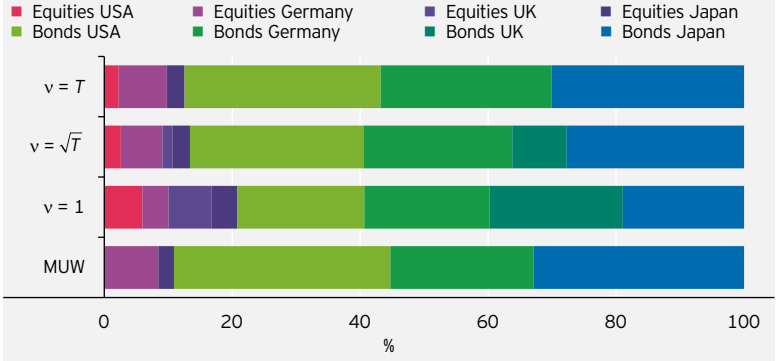
In the case of the utility maximizing allocation, smaller samples show strikingly large deviations from the true utility. This is attributable to the sensitivity of this concept to outliers. With the probabilistic utility function, the diversification is lower.

Figure 3: Deviation from true utility



Source: Invesco. Based on month-end data from October 1998 to September 2013.

Figure 4: Portfolio weights



Source: Invesco. Based on month-end data from October 1998 to September 2013.

The greater the sample size, the more closely the moments of the two solutions diverge even if the deviations from the true utility are somewhat smaller in the case of the probabilistic utility optimization.

Finally, based on the returns for the entire observation period we compare the allocations for different values of ν with the utility maximizing allocation. The parameter ν assumed the values $\nu_1 = 1$, $\nu_2 = \sqrt{T}$ and $\nu_3 = T$. The risk aversion parameter λ was set at 0.9. Figure 4 illustrates the allocations.

The utility maximizing allocation (shown in figure 4 as "MUW") turns out to be highly-concentrated; approximately two thirds of it comprise Japanese and US government bonds. Apart from the DAX, there were evidently no significant exposures to equities. The probabilistic optimization reveals a lower concentration for all values of ν. Even with $\nu = T$, i.e. a sample range of 179 observations, the allocation would have been more balanced.

Summary

For the probabilistic interpretation of utility functions, the portfolio weights themselves are considered as random variables; in this case, the optimum allocation is their expected value. In broad principle, this approach is suitable for every utility function, in other words also for functions with one-sided risk measures or risk neutrality. However, for simplification purposes or better comparison we have used the function familiar from the Markowitz approach.

The simulation study has shown that the probabilistic interpretation of utility functions can lead to far lower portfolio concentrations than the traditional utility maximizing allocation. It therefore serves as an alternative to robust estimators or optimization processes.

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Literature

- Brooks, S., A. Gelman, G. Jones and X.-L. Meng (ed.) (2011). Handbook of Markow Chain Monte Carlo. Boca Raton, FL: Chapman & Hall / CRC.
- Duane, S., A. Kennedy, B. Pendleton, and D. Roweth (1987). Hybrid monte carlo. Physical Letters B195, 216–222.
- Gilks, W., S. Richardson and D. Spiegelhalter (1995). Markov Chain Monte Carlo in Practice. Interdisciplinary Statistics. Boca Raton, FL.: Chapman & Hall / CRC.
- Marschinski, R., P. Rossi, M. Tavoni, and F. Cocco (2007). Portfolio selection with probabilistic utility. Annals of Operations Research 151, 223–239.
- Michaud, R. (1989). The markowitz optimization enigma: Is optimized optimal. Financial Analyst Journal 45, 31–42.
- Michaud, R. (1998). Efficient Asset Management: A Practical Guide to Stock Portfolio Optimization and Asset Allocation. New York: Oxford University Press.
- Neal, R. (2011). Handbook of Markov Chain Monte Carlo, Chapter MCMC using Hamiltonian dynamics, pp. 113–162. Handbooks of Modern Statistical Methods. Boca Raton, FL: Chapman & Hall / CRC.
- R Core Team (2013). R: A Language and Environment for Statistical Computing. Vienna, Austria: R Foundation for Statistical Computing.
- Rossi, P., M. Tavoni, F. Cocco and R. Marschinski (2002, November). Portfolio selection with probabilistic utility, bayesian statistics and markov chain monte carlo. eprint arXiv arXiv:cond-mat/0211480, 1–27. http://arxiv.org.

Notes:

1 Risk & Reward, 3rd and 4th Quarter 2011
2 The validity of each step can be determined, for example, using the Metropolis-Hastings algorithm.
3 Thomson Reuters DataStream was used as the data source. The mnemonics of the time series in the order mentioned above are: ISPCS04, GDXCS04, LSXCS04, ONACS04, CTYCS04, GGECS04, LIGCS04 and JGBCS04.
4 All calculations were carried out using the free statistical programming environment R 3.0.2 (see R Core Team, 2013) and the GRIMS package (see Neal, 2011).

New approaches to portfolio optimization: A summary

This is the final article in the series which we started in the 2nd quarter 2011 on the 60th anniversary of Markowitz's groundbreaking work "Portfolio Selection". In a series of twelve articles we presented the classic Markowitz optimization approach, its developments and extensions and the resultant portfolio concepts:

Part	Issue	Theme
1	Q2 2011	Mean-variance optimization
2	Q3 2011	Robust estimators
3	Q4 2011	Robust optimization methods
4	Q1 2012	VaR optimum and CVaR optimum portfolios
5	Q2 2012	Drawdown optimum portfolios
6	Q3 2012	"Most diversified portfolios"
7	Q4 2012	Tail-dependent portfolio optimization
8	Q1 2013	Equal risk contribution portfolios
9	Q3 2013	The Black-Litterman approach
10	Q4 2013	Copula opinion pooling
11	Q1 2013	Entropy pooling
12	Q2 2013	Probabilistic utility functions

The classic Markowitz optimization approach, when put into practice, frequently results in a strong concentration on a few financial instruments. Added to this, even the slightest parameter change has major consequences for optimum portfolio allocation.

We therefore presented methods which counter these weaknesses: robust estimators mitigate the influence of outliers and, by extension, lower portfolio concentration while robust optimization methods ensure greater stability in the event of parameter changes.

Consideration was then given to various risk indicators. Markowitz deems a portfolio to be optimum if the relation between return expectations and return variance ("volatility") is appropriate. But not all investors share this view. Other alternatives are portfolio-VaR (or CVaR) and portfolio drawdown. We have shown the consequences that these have for portfolio optimization.

Views also diverge when it comes to the meaning of portfolio diversification. Traditionally it is measured on the basis of the return covariances between the individual positions. But here, too, there are alternatives – the "Most Diversified Portfolio", diversification measures which only capture simultaneous losses and a portfolio concept in which all positions make equal contributions to aggregate risk.

Finally, we dealt with the question of modelling individual return expectations, the classic Black-Litterman approach along with its extensions Copula Opinion Pooling and Entropy Pooling. The final article dealt with expected utility maximization as a basis for portfolio optimization.

The risk-return paradigm is still a set component of quantitative optimization methods today. But risks are modelled and defined differently due not least to the financial market crisis of the last ten years. Optimization methods were introduced which only consider losses; market risks were modelled more precisely and interdependencies captured more efficiently.

Depending on the investor's preference, one or other of these approaches can be optimum. But this is where the difficulty lies: in the final analysis, whichever approach is chosen remains a subjective decision – but one of great importance.

Investing in the emerging markets – with developed market stocks

Equities are usually thought of in terms of stocks from developed markets or stocks from emerging markets. But this distinction is too simple since many companies from the industrialized countries generate a large part of their sales in the emerging markets and are therefore dependent on their economic development. We have compiled a portfolio of such companies and examined their performance.

In past decades emerging markets' share of global GDP has risen, in 2013 to approximately 50%.[1] However, their share in global market capitalization, measured in terms of the MSCI All Country World Index, amounts to only 11%.[2] Furthermore, emerging market investments also frequently encounter regulatory and administrative obstacles.

An alternative to investing directly in emerging market stocks is to invest in stocks of companies from the industrialized countries which generate a large part of their sales in the emerging markets and therefore respond accordingly to the development of these countries. With this indirect concept, investors can exploit the growth potential of the emerging markets but avoid the regulatory and administrative risks since these companies are domiciled in an industrialized country. Other advantages are often higher liquidity, lower volatility and the frequently lower transaction costs associated with stocks from industrialized countries. Studies also reveal a positive connection between a company's internationality and its productivity.[3] This is explained by the fact that companies with a higher share of foreign sales could deploy their capital more efficiently, to the benefit of the shareholders. For the most part, return on capital and return on equity have also been higher than profit growth, and the incidence of positive earnings surprises has also been higher. A possible reason for this is the greater complexity of international companies which makes their earnings more difficult to forecast.[4]

In this article we present a concept which seeks out stocks from industrialized countries with close ties to the emerging markets, and compare their performance with that of the MSCI World Index and the MSCI Emerging Markets Index.

Data and methods

The starting point of our analysis is company sales broken down by region. We obtain this data from the database Worldscope which distinguishes between up to ten countries or country groups. Besides sales, Worldscope also documents operating profits and other statistics but we consider the sales figures to be the most appropriate. They highlight most clearly where a company generates its business and offer little scope for manipulation. Added to this, the data pool is more extensive.

For company *i*, we term its sales in the developing countries as a proportion of its aggregate sales of the month *t* as the Emerging Market Exposure Score (EmExp):

$$EmExp_{i,t} = \frac{\sum_{k=1}^{10} sales_{i,t}^{k} * EMflag_{i,t}^{k}}{\sum_{k=1}^{10} sales_{i,t}^{k}}$$

with

$$EMflag_{i,t}^{k} = \begin{cases} 1 & \text{if the country or country group } k \text{ counts as emerging market} \\ 0 & \text{if the country or country group } k \text{ does not count as emerging market} \end{cases}$$

Using a large Swedish truck company as an example, table 1 explains how we calculate the Emerging Market Exposure Scores. We begin by computing the share of sales for each of the ten regions in percentage terms. We then classify the regions as emerging markets or industrialized countries. In a final step, we add the share of sales for all of the emerging markets together to calculate the Emerging Market Exposure Score.

The sales classification is made difficult by the fact that companies do not always deliver comparable data. Some companies state figures for the individual

Table 1: The Emerging Market Exposure Score using a large Swedish truck company as an example

	Sweden	Europe	USA	Asia	France	China	Japan	Brazil	North America	South America	EmExp Score
Sales (EUR m)	12,133	75,200	56,441	30,301	24,273	19,990	18,987	18,662	14,660	10,502	**281,149**
Sales share (%)	4.3	26.7	20.1	10.8	8.6	7.1	6.8	6.6	5.2	3.7	**100.0**
Emerging market?	0	0	0	1	0	1	0	1	0	1	
Contribution to EmExp (%)	0.0	0.0	0.0	10.8	0.0	7.1	0.0	6.6	0.0	3.7	**28.2**

Source: WorldScope, Invesco calculations. Data for December 2012. For illustrative purposes only.

countries, others only for regions. These regions might contain both industrialized countries as well as developing countries. For example, "North America" includes both Canada and Mexico. We classify this region under the industrialized countries since Canada dominates. A more precise system of country classification would improve our concept, but we also consider the current method to be acceptable.

Figure 1, which also uses the same company as an example, shows how the sales share of the emerging markets can alter over time. In 1999 the developing countries accounted for only 5% of aggregate sales compared with a good one quarter in 2012. Hence, the opportunities and risks from a company's emerging market exposure changes over the course of time. An active manager who classifies stocks solely on the basis of the country of location or country of the primary stock market listing (in this case both Sweden), omits this aspect from their analysis.

Empirical results

To carry out our analysis, we compiled a portfolio of all stocks of the Invesco Quantitative Strategies (IQS) Research Universe[5] with a positive Emerging Market Exposure Score. Each stock's weighting corresponds to the market capitalization and is thus purely passive; it was adjusted once a month. We term this portfolio the "EM exposure universe".

For the period January 1997 to December 2012[6], i.e. a total of 16 years, we compared the performance of the EM exposure universe with that of the MSCI World and MSCI Emerging Markets (figure 2). During this time, the EM exposure universe gained 191% in value (6.9% p.a.), the MSCI Emerging Market Index 233% (7.8% p.a.) and the MSCI World 131% (5.4% p.a.) (table 2). While the stocks of industrialized countries with links to the emerging markets remain behind the MSCI Emerging Markets, they were ahead of the MSCI World.

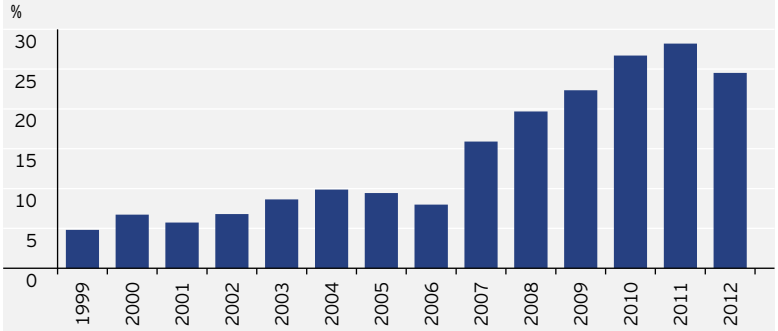
However, the volatility of the EM exposure universe was significantly lower than that of the MSCI Emerging Markets – and was actually somewhat lower than that of the MSCI World (figure 3). The result was a far better risk-adjusted performance, i.e. a higher Sharpe ratio (table 2).

Especially in times of crisis our portfolio of stocks from industrialized countries with links to emerging markets have performed far better than the classic emerging market stocks. In the ten months with the largest negative monthly returns of the MSCI Emerging Markets, it was clearly in the lead (table 3). The increase in risk aversion typical in crisis periods resulted in a far greater collapse in the emerging market stocks than the stocks of the EM exposure universe.

Conclusion

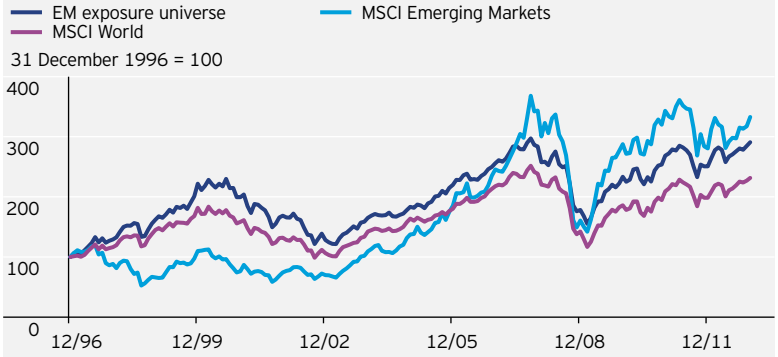
Anyone shying away from direct investment in emerging markets can invest in stocks of industrialized companies with links to the emerging markets. But such stocks can also potentially benefit industrialized country portfolios – since on the whole they are stocks of international players, often with above-average performance.

Figure 1: Share of emerging markets in sales of a large Swedish truck company



Sources: Worldscope, Invesco calculations. Data as at December 2012. For illustrative purposes only.

Figure 2: Performance comparison



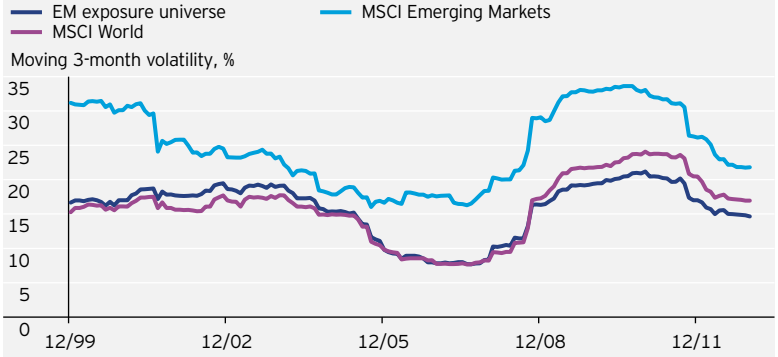
Sources: MSCI, Invesco. Data as at December 2012. Past performance is not a guarantee of future performance. An investment cannot be made into an index.

Table 2: Comparison of performance and risk

	Performance p.a. (%)	Volatility (%)	Sharpe ratio
EM exposure universe	6.9	16.2	0.3
MSCI Emerging Markets Index	7.8	25.5	0.2
MSCI World Index	5.4	16.5	0.2

The risk-free interest rate used for the Sharpe ratio was the yield on a 3-month US T-bill.
Source: Invesco. Data period: January 1997 – December 2012.

Figure 3: Comparison of volatility



Sources: MSCI, Invesco. Data as at December 2012.

Table 3: Performance in times of crisis

Event	Date	EM exposure universe (%)	MSCI Emerging Markets (%)	Difference (percentage points)
Russian crisis, collapse of LTCM	August 1998	-13.9	**-28.9**	15.0
Financial crisis	October 2008	-16.5	**-27.4**	10.9
Financial crisis	September 2008	-11.5	**-17.5**	6.0
Asian crisis	October 1997	-5.7	**-16.4**	10.7
9/11	September 2001	-10.2	**-15.5**	5.3
Period after the financial crisis	September 2011	-7.1	**-14.6**	7.4
Asian crisis	May 1998	0.0	**-13.7**	13.7
Asian crisis	August 1997	-6.6	**-12.7**	6.1
Financial crisis	January 2008	-9.3	**-12.5**	3.1
Period after the financial crisis	May 2012	-7.2	**-11.2**	4.0

Sorted by MSCI Emerging Markets Index performance.
Sources: Datastream, Invesco. Monthly returns in USD.

As the companies disclose ever more information on the regional structure of their sales, it is becoming increasingly easier to compile the emerging market exposure of portfolios. Despite a number of gaps, we believe the data pool is already sufficient.

What makes this concept particularly interesting is the prospect of a Sharpe ratio above that of the MSCI World and MSCI Emerging Markets. Furthermore, the concept can be combined in any number of ways with different investment processes, particularly quantitative ones.

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Literature

- Elhanan Helpman & Marc J. Melitz & Stephen R. Yeaple (2004): Export Versus FDI with Heterogeneous Firms, American Economic Review, American Economic Association, vol. 94(1), pp. 300-316.
- Raymond Mataloni, Jr. (2011): The Productivity Advantage and Global Scope of U.S. Multinational Firms," Working Papers 11-23, Center for Economic Studies, U.S. Census Bureau.
- Dubravko Lakos-Bujas et al. (2013): Harnessing Geographic Revenue Exposure Implications for Stock Selection" JP Morgan Research Report.

Notes:
1 Source: IMF estimate, measured in terms of purchasing power parity
2 Source: MSCI, as at 31. December 2013
3 See Helpman et al. (2004), Mataloni (2011) and Lakos-Bujas et al. (2013)
4 Ibid
5 The investment universe comprises some 3,000 of the world's largest and most liquid companies which, together, account for 95-100% of the market capitalization of the most important international or regional large cap indices. All stocks must fulfill minimum requirements for liquidity and market capitalization and must be listed.
6 The database only permits an analysis for this period.

Liquid alternatives – more than just return potential

Institutional investors, mostly in Europe and the US, have been increasing their exposure to alternatives to improve diversification, better mitigate risk and enhance return potential. But many alternative investments are fairly illiquid. This is where so-called liquid alternatives come in.

As we will discuss here, liquid alternatives are hedge fund-like strategies that typically consist of publicly traded equity and fixed income investments. They are a collection of unconventional actively managed strategies, using a variety of exposures (long, short, market neutral) and financial instruments to extract different returns at different times.

As with most alternative strategies, historically liquid alternatives have tended to be lowly correlated with traditional equity and fixed income investments.[1] But whereas many alternative strategies, such as real estate and private equity are often fairly illiquid, liquid alternatives are not.

Usually, liquid alternatives are managed without the significant constraints that typically accompany traditional fixed income and equity investments, allowing for greater return potential. As a result, historically, liquid alternatives were solely considered "return" generators, but since the financial crisis of 2007-2008 their risk-diversifying attributes have attracted greater attention.

The incorporation of liquid alternatives into asset allocation has evolved over the years from investing in single funds as a component of the broader alternatives category to being carved out as a separate asset class with a pre-specified percentage allocation that could be implemented with a more integrated, multi-strategy approach. More recently, a customized multi-strategy approach is being promoted that seeks to align investors' goals with their expected outcomes. This approach allows for a more expansive use of liquid alternatives as complements or substitutes to a traditional fixed income and equity allocation. The original goal of diversified incremental returns and risk mitigation remains, but may now lead to greater utility from investor portfolios.

Why liquid alternatives have become popular

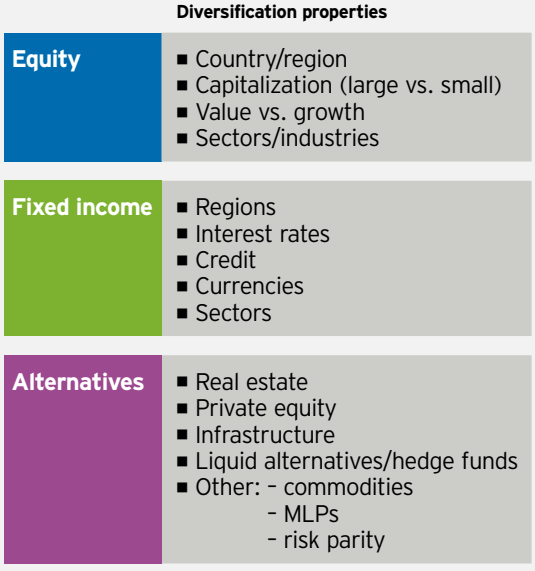
We believe several key factors have led to the current market appetite for liquid alternatives. Most notably is the rise and fall of global equity markets over the past 15 years, as well as the current low interest rate environment, which has encouraged investors to seek innovative ways to balance risk and reward. Increasing product availability within better-regulated funds – UCITS in Europe and mutual funds in the US – has also enhanced investor willingness to adopt these strategies. Historically, they were primarily available through private, unregulated hedge funds. Greater accessibility has also heightened investor interest because the regulated funds also carry meaningfully lower investment minimums than private hedge funds, which typically have had higher investor qualifications. Lastly, greater transparency, which provides investors with the ability to look through to underlying holdings, and the ability to sell their investment on short notice relative to private hedge funds, has also increased investor comfort level with liquid alternatives.

The case for liquid alternatives

Today, the primary case for investing in liquid alternatives is diversification. Liquid alternatives' historical return pattern has tended to be complementary with traditional equity and fixed income returns. Historically, these returns have also been achieved with lower downside risk – that is, lower risk when equity markets were not performing well. Better downside risk management, which can involve avoiding losses in stressed market conditions, has historically resulted in better performance during market downturns for liquid alternatives relative to traditional equity and fixed income allocations.

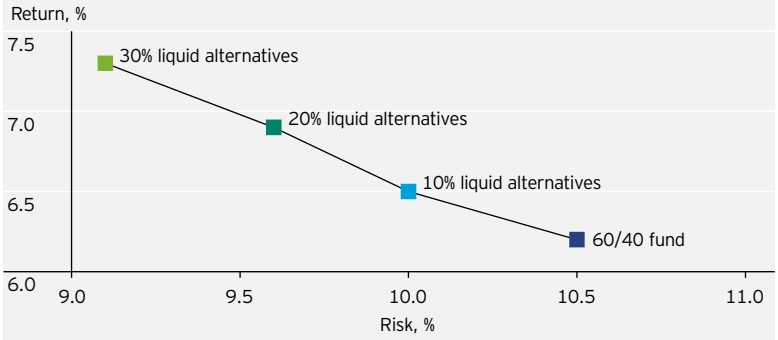
To most investors, the benefit of diversification is obvious and has been recognized for over a half a century. As shown in figure 1, there are many layers of diversification within equities, fixed income and alternatives. Investors invested in these categories have diversified beyond geography to include market or risk-based factors that drive returns, such as size and style within equities, and interest rates and credit within fixed income. Even the alternatives category was generally diversified across a broad collection of investments. Harry Markowitz's Modern Portfolio Theory (MPT), published during the 1950s, suggested that a properly diversified portfolio comprised of lowly correlated assets, would earn a return equal to the weighted return of all of the component

Figure 1: Diversification, diversification, diversification



Source Invesco, April 2014. For illustrative purposes only.

Figure 2: Adding liquid alternatives may have risk/reward benefits



	60/40 fund	10% liquid alternatives	20% liquid alternatives	30% liquid alternatives
Return (%)	6.20	6.50	6.90	7.30
Risk (%)	10.50	10.00	9.60	9.10
Sharpe ratio	0.35	0.40	0.45	0.51

Source: Zephyr StyleADVISOR. "60/40 fund" refers to the returns of a portfolio that is 60% MSCI World (net of dividends) and 40% Citigroup World Government Bond Index; "Liquid alternatives" refers to the returns of the BarclayHedge Hedge Fund Index, which serves as a proxy. An investment cannot be made directly into an index. Risk is the annualized standard deviation of monthly returns. Return and risk are annualized and stated in USD. Assumes quarterly rebalancing to targets. This hypothetical example is presented for illustrative purposes only and does not represent the performance of any particular investment. Past performance is not a guarantee of future results.

assets, but with lower portfolio risk overall than the weighted risk of each individual security.

As shown in figure 2, incrementally adding a liquid alternatives allocation to a 60/40 portfolio would have improved absolute returns, lowered portfolio volatility, and thereby increased risk-adjusted returns from January 1997 through December 2013. A 100% allocation to the MSCI World Index, would have delivered an annualized return of 6.6%, but with substantially higher volatility, about 16%, resulting in a lower Sharpe ratio of about 0.25.

Introducing liquid alternatives into asset allocation

Liquid alternatives have gained acceptance in recent years, but questions still remain about the best ways to incorporate them into an asset allocation strategy. Once the case for liquid alternatives is made and the risks and the benefits of diversification have been discussed, the next logical step to consider is how to build a portfolio that includes them. Asset allocation in the traditional framework is challenging because liquid alternatives are a disparate collection of strategies with different return streams that vary over time, so it is difficult to bind them together as one asset class, comparable to fixed income or equities.

Figure 3 illustrates the risk/return achieved from January 1997 to December 2013 using a sample of the liquid alternatives strategies available in the BarclayHedge Alternative Investment database. This demonstrates that most of these strategies have historically been less volatile than global equities, however, the range of realized returns has varied significantly.[2]

This illustration typically elicits many questions from investors about how to determine what type of liquid alternative strategies would best meet their return and risk objectives, as well as the optimal asset allocation percentage. While frequently discussed, there still is not a consensus among asset allocation practitioners on what the optimal asset allocation to liquid alternatives should be.

To help answer these questions, investors would likely benefit from establishing a framework to use them in their portfolio. The true benefit of liquid alternatives is how they perform in combination with the entire portfolio, including how they balance risk and return.

Just as it's necessary to select an optimal mix of equities and fixed income investments that are

Figure 3: A sampling of liquid alternative strategies

BarclayHedge Alternative Investment Database: risk vs return (January 1997 – December 2013)

MSCI World and Citi World Govt Bond are shown for comparison.
Source: BarclayHedge Alternative Investment Database. This computerized database tracks and analyses the performance of 6,723 hedge fund and managed futures investment programs worldwide. BarclayHedge has created and regularly updates 18 proprietary hedge fund indices and 10 managed futures indices. Please note: BarclayHedge is not affiliated with Barclays Bank or any of its affiliated entities. Performance for funds included in the BarclayHedge indices is reported net of fees. Past performance is no guarantee of future results.

Figure 4: A framework for investing in liquid alternatives

	Absolute return	Macro	Opportunistic
Role in portfolio	Hedge equity/fixed income risk	Hedge macro environmental and equity risk	Hedge equity risk
Liquid alternative strategies	■ Relative value ■ Market neutral ■ Fixed income arbitrage	■ Global macro ■ Managed futures/CTA ■ Multi-strategy	■ Long/short ■ Event driven ■ Non-fixed income arbitrage ■ Distressed
Directionality*	Low: 0 to 20% market exposure	Medium: varies based on manager insights	High: > 60% exposure to market movements
Expected long-term risk	≈ Fixed income risk	≈ Fixed income risk	< Equity risk
Typical allocation bucket	Absolute return	Absolute return	Equity or absolute return

* Directionality measures the degree of exposure a strategy has to movements in the equity and fixed income markets.
Source: Invesco, April 2014. For illustrative purposes only.

consistent with the investor's goals, a similar philosophy holds for selecting a diversified mix of liquid alternatives. That's because a strategy that only focuses on buying alternatives is likely to be insufficient and could lead to disappointment.

Figure 4 illustrates how to identify a range of options for closer consideration using an approach that is more aligned with historic realized risk or standard deviation. One key risk measure could be ascertained by understanding either the directionality or the degree of exposure a strategy has to movements in the equity and fixed income markets. Another measure of risk could be ascertained by analyzing downside correlation or performance in different economic regimes or market cycles, while paying particular attention to strategies that perform best when equity markets overall are not performing well. In addition to standard risk measures, it is also important to investigate the historical pattern of major losses or extreme outcomes in a strategy, as event risk can be high. Once these risk measures are assessed, it may be easier to choose liquid alternatives for inclusion in a portfolio as complements or surrogates for equity and fixed income allocations. Investors can also consider investing in these strategies tactically based on varying economic circumstances related to growth and inflation.

Armed with this information, investors can also establish a framework (as shown in figure 5) that aligns the categories shown in Figure 3 with their investment goals – generally identified as income, growth or opportunistic. Investors will likely benefit from a practical, common sense approach that also considers risk tolerance rather than a single objective of return, as not all alternatives

Figure 5: Aligning investor goals within their allocation to liquid alternatives

	Income	Growth	Opportunistic
Role in portfolio	■ Risk diversifier ■ Return enhancer	■ Risk diversifier ■ Return enhancer	■ Risk diversifier ■ Return enhancer
Liquid alternative strategies	■ Relative value ■ Market neutral ■ Fixed income arbitrage	■ Long/short ■ Global macro ■ Managed futures/CTA ■ Multi-strategy	■ Event driven ■ Non-fixed income arbitrage ■ Distressed
Expected long-term total return	> Fixed income yields	60% equity/ 40% fixed income	Equity plus

Source: Invesco, April 2014. For illustrative purposes only.

are equal, or attractive, investments when used at same time.

Hurdles to investing in liquid alternatives
Thankfully, the major hurdles of availability, accessibility, transparency and liquidity have been remedied. But, as one would suspect, a few manageable challenges remain. For example, liquid alternatives are often misunderstood, but ongoing education can help to lessen investor concerns. The education gap can be considerable, and understanding the return/risk profile of the various strategies and marrying them with the investor's individual goals and objectives is a complicated, but is a necessary next step that should be a pre-requisite before investing.

Investors also have a heightened sensitivity to alternatives due to the headline risk associated with fraud cases and manager misconduct played out in the media. The use of derivatives and leverage is often perceived negatively as well, without the consideration of their accompanying attributes of liquidity and enhanced return potential. However, these risks are likely exaggerated given the disclosure and reporting requirements for regulated vehicles. Ironically, Figure 2 illustrates that when liquid alternatives are systematically combined with core holdings, aggregate portfolio risk can be reduced. Figure 3 illustrates that, historically, the realized risk of any one liquid alternative strategy, as measured by standard deviation is lower relative to global equities as measured by the MSCI World Index.

While it is true that regulated liquid alternative funds often have higher management fees than traditional investments, they could be substantially lower than fees for private hedge funds, which generally have a two-tiered fee model that includes management, plus performance fee incentives.

The near future for liquid alternatives
With expectations that we'll be in a low-return environment for the next several years, interest in alternative investments is only expected to heighten. In fact, institutional investment globally in hedge funds may rise from about USD1.5 trillion in 2012 to USD2.3 trillion by 2017, according to a 2013 report by Citi Prime Finance.[3]

The financial crisis taught investors enduring lessons, one in particular was how highly correlated markets can be in a downturn. Because alternatives have the ability to offer a different return pattern at different times than traditional asset classes, they can be a reasonable complement or surrogate for equity and fixed income market exposure.

In our experience, such capabilities, along with their increased accessibility, have made liquid alternatives attractive to retail investors in the US and Europe, who are allocating assets to such strategies for many of the same reasons as institutional investors – diversification, risk mitigation and enhanced return potential. In fact, much of the growth in assets that we expect to be allocated to alternatives over the next few years could come from retail investors.

Conclusion
The evolution of more accessible and transparent liquid alternative investments may help make alternative strategies suitable for more investors, depending on their goals, risk tolerance and expectations. They may provide an added element to volatility management or another opportunity for enhanced return potential.

It is important to take the lessons learned from the financial crisis to heart, and therefore, look to cushion one's investments from the asset correlation and volatility that may occur on short notice. Investors can be better prepared for a variety of market environments by including liquid alternatives in their portfolios.

Donna Wilson, Director of Portfolio Management
Invesco Quantitative Strategies

Notes:
1 Source: BarclayHedge Indices: correlation of monthly hedge fund returns versus MSCI World and Citi World Government Bond Index. January 1997-December 2013
2 It should be noted that manager databases or peer groups are typically used to measure performance of liquid alternative strategies; there is no standard investable index. While these databases report performance net of fees, they are fraught with high survivorship bias from managers and /or funds that close and stop reporting fund information, which could result in inflated returns. In addition, there is limited homogeneity, meaning that no one strategy is alike even within major categories, resulting in wide dispersion between top- and bottom-performing managers.
3 Citi Prime Finance, The Rise of Liquid Alternatives & the Changing Dynamics of Alternative Product Manufacturing and Distribution, May 2013

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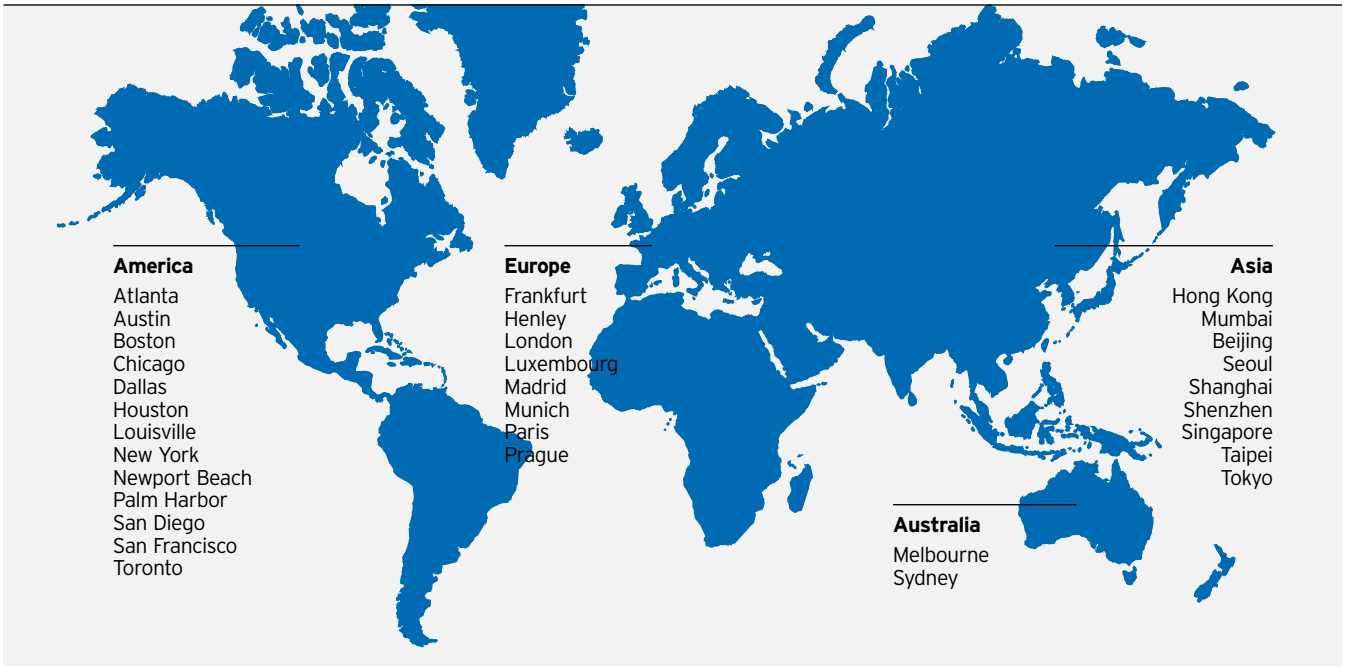

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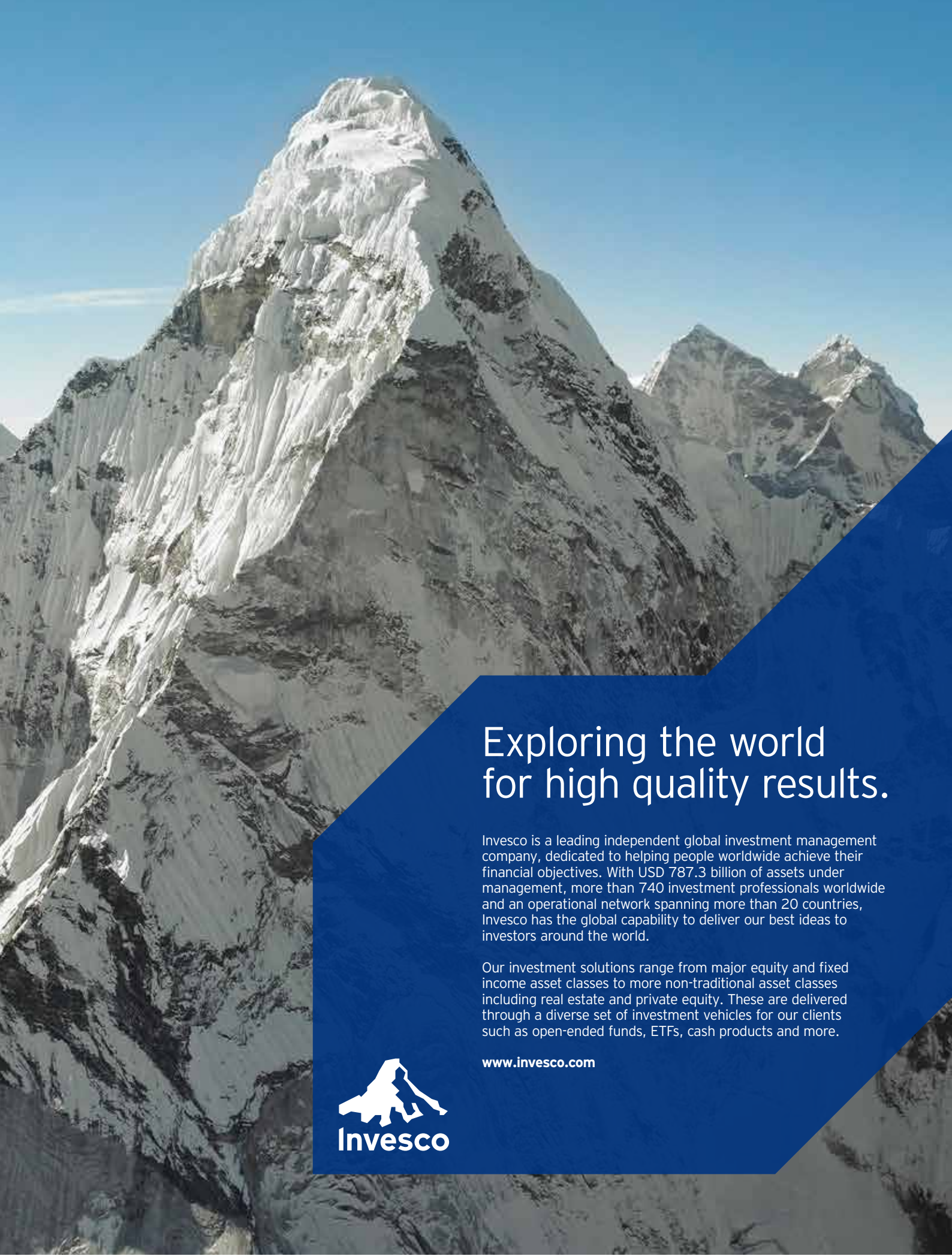

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