

# Risk On – Risk Off

Fixing a broken investment process



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**Disclosures and Disclaimer** This report must be read with the disclosures and analyst certifications in the Disclosure appendix, and with the Disclaimer, which forms part of it

# Executive Summary

## Risk On – Risk Off has broken the investment process

“Risk On – Risk Off” (RORO) has been one of the most striking developments in global markets since the start of the financial crisis. Accepted wisdom has been overturned and, for many asset managers, the investment process is quite simply broken. High correlations are dominating and, while they have weakened in recent months, they remain strong – similar to levels seen immediately post-Lehman. In this piece, we extend earlier work on RORO to explicitly include emerging markets and stock-level equities. Crucially, we also look at how managers can adapt their investment process to cope with the phenomenon and take advantage of it.

## Damaged principles

Asset managers have until recently been able to rely on some basic tenets:

- ▶ Markets respond to their own fundamentals
- ▶ Diversification can be achieved across asset classes
- ▶ Active strategies can generate independent excess return

The high correlations of today’s Risk On – Risk Off world mean these principles can no longer be relied upon. In a world where disparate assets move in lockstep, their individual identities become lost. Assets now behave as either risky assets or safe havens, and their own fundamentals are secondary.

Synchronised markets provide little diversification and many active strategies fail to provide useful independent returns. This presents a profound challenge for investors. It also raises serious issues for other participants, such as corporate treasurers, whose business plans depend on asset and commodity price behaviour.

## Knowing the enemy – Understanding RORO (page 3)

The first step in handling the RORO phenomenon is to measure it and track it. The first section of this piece “Understanding RORO” looks at the various HSBC indices that have been created to achieve this. We look at how the general phenomenon can be visualised using heatmaps and how its strength can be quantified using the HSBC RORO index. We also describe our recently introduced EM RORO and Equity RORO indices and look at how the influence of RORO on individual assets can be monitored – some markets, such as GBP and natural gas, often manage to hold on to their independence.

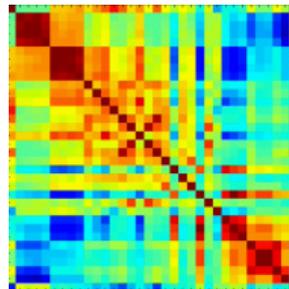
## Adapting the process – RORO and investing (page 14)

The second section “RORO and Investing” looks at how high cross-asset correlations have serious repercussions for the investment process. As well as destroying diversification, RORO overwhelms active strategies such as FX carry and equity long/short. We look in detail at the pervasive influence of RORO and how it can be tackled. Solutions include identifying those strategies which are unaffected and modifying existing strategies to actively counter the RORO contamination. This can be achieved by dynamically hedging out its effects in a way that adapts to the changing strength of RORO, and by more judicious portfolio construction.

**Click the image below to view the related interview with Stacy Williams**



**Click the image below to view the correlation heatmap movie (see page 6 for details)**



# Understanding RORO

## A challenge at the heart of the investment process

High correlations continue to dominate markets. This “Risk On – Risk Off” (RORO) phenomenon leaves no asset class untouched and presents a new and formidable challenge for investment managers. The benefits of diversification across asset classes have evaporated and even most active strategies, such as relative-value and FX carry, have become overwhelmed. For many managers, the investment process is now broken.

In this piece, we look at how RORO can be tracked and how its influence on particular markets can be identified and measured. We see how the reach of RORO into the investment process is much deeper than is obvious, creating distortions and destroying value. Importantly, we also see that while RORO is a major problem, there are ways of adapting the investment process to counter its effects. We believe the phenomenon is here to stay and actively addressing it must be a primary consideration for all market participants.

## What exactly is Risk On – Risk Off?

Risk on – Risk off (RORO) is the phenomenon of increased market correlations that developed during the financial crisis. The collapse of Lehman Brothers in 2008 precipitated the rise, and correlations have been high and generally rising ever since. Assets can now be characterised as either risky or safe-haven in nature, and have lost a great deal of their individual identity. During “risk on” periods, risky assets rally in unison and safe-haven instruments fall. During “risk off” periods, these moves swing into reverse. The mood of the markets oscillates between optimism and pessimism and, with it, these now synchronised markets move predominantly as one.

## A brief history of RORO

RORO behaviour in markets only truly started when Lehman collapsed, but the signs were there in 2007 when the financial crisis was in its infancy. The Lehman bankruptcy caused a seismic intensification of correlations but they had already started to rise. Bernanke’s sub-prime warning in 2007 and the run on Northern Rock later that year were pivotal moments in the development of the phenomenon. Both events resulted in greater synchronisation across a large array of disparate asset classes, and this event-driven nature of RORO is crucial to understanding it. The detailed development of RORO through time has been covered in our earlier piece, [‘Risk on – risk off: the full story’](#), November 2010) and the main message is clear: RORO intensifies rapidly whenever “unsettling” news occurs and is very slow to dissipate. RORO is event-led and strongly coupled to uncertainty.

## What is causing RORO and when will it end?

There are several competing, though related, theories about what exactly is causing RORO. It is a reality that needs to be addressed whatever the explanation, but the prognosis for RORO and its predicted longevity does depend somewhat on what is ultimately driving it. Possible drivers include:

- 1 RORO is caused by easier market access through the growth of electronic trading and ETFs
- 2 RORO is the inevitable conclusion of globalisation and CAPM
- 3 RORO is a consequence of a new systemic risk factor

In our view, the ease of access argument is probably part of the explanation but not the underlying cause. ETFs and electronic trading have grown in recent years but they were already significant pre-Lehman and, since then, there has been significant de-leveraging. The event-led nature of the correlations also suggests that access alone is not a big enough explanation. It is part of the mechanism, rather than the cause.

The second argument advocates that as global markets become more connected, a single global risk premium emerges. Markets become more correlated as investors hone in on a single global *beta* which is accessed most efficiently through global multi-asset portfolios; i.e. such correlations were ultimately inevitable even without a crisis. Again, while there must surely be some truth in this argument, it is not consistent with the event-led behaviour of the RORO phenomenon. It would account for a general rise in correlations, but not the rapid and extreme rises we have seen.

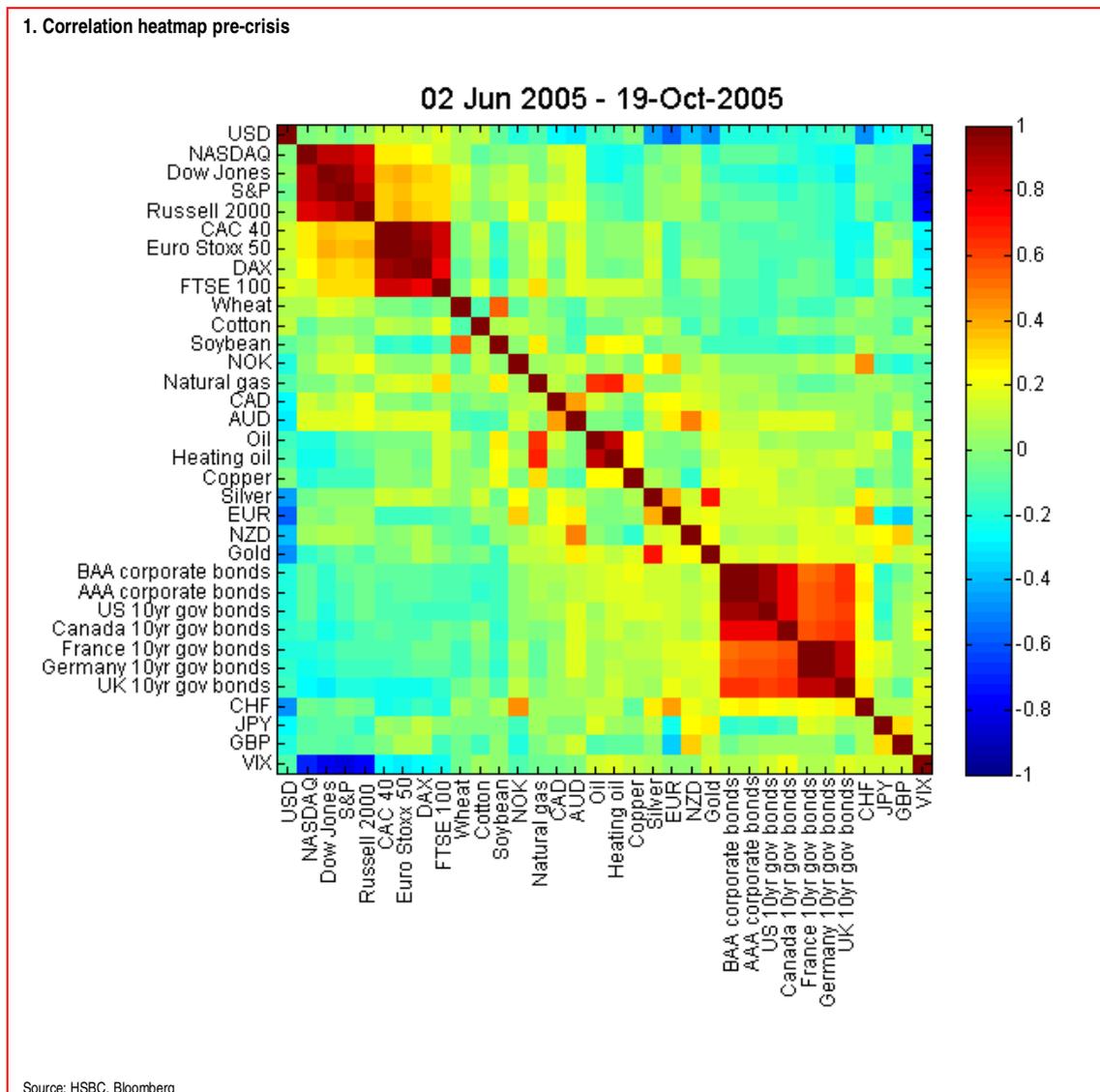
We believe the third argument is compelling. RORO is a direct result of a new systemic risk factor. We have seen global intervention, QE and policy response of an unprecedented scale across many countries – and markets are pricing in the bimodal nature of the consequences. Ultimately, either policy response works and there is indeed a global recovery, or they fail and the sovereign debt issues across the developed world lead to new and even more serious crises.

Individual assets, while still influenced by their own fundamentals, are dominated by the changing likelihood of such a recovery. Disparate markets now have an ascendant common price component and correlations surge whenever an unsettling event increases the degree of uncertainty.

If our explanation is correct then correlations should fall when global uncertainty dissipates. This is likely to take some years, but ultimately RORO would be much weaker eventually. The alternative explanations would imply a structural change, with RORO remaining indefinitely. Either way, from a pragmatic point of view, RORO is here to stay for a while and needs to be actively addressed.

## Measuring the RORO phenomenon

The first step in handling the phenomenon of RORO is to track it. This needs a diverse range of assets and it is important to handle the fact that RORO behaviour manifests itself through the increase of both positive and negative correlations. Simply looking at average correlations won't work. To track the strength of Risk On – Risk Off we have developed the HSBC RORO index, but before we look at this, it is illuminating to look at the phenomenon using heatmaps.



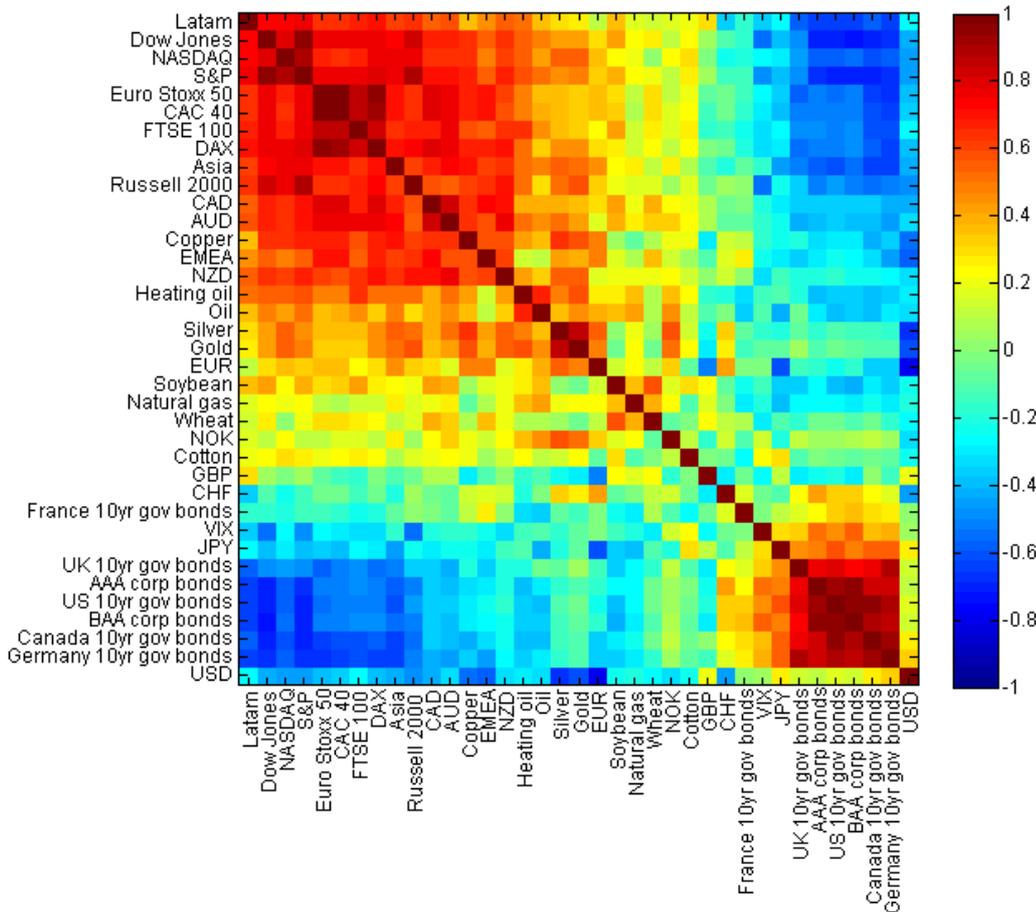
## Heatmaps

Chart 1 shows a correlation heatmap from a pre-crisis period in 2005. The heatmap is simply a correlation matrix of a group of representative global assets. Red indicates strong positive correlation and blue indicates strong negative correlation. Greens and yellows appear when correlations are close to zero.

The striking feature of the heatmap is the sea of green. Patches of red and blue are few, and this is representative of what the heatmaps look like for all periods going back to 1990, when our analysis begins.

2. Correlation heatmap post-Lehman

As of April 2012



Source: HSBC, Bloomberg

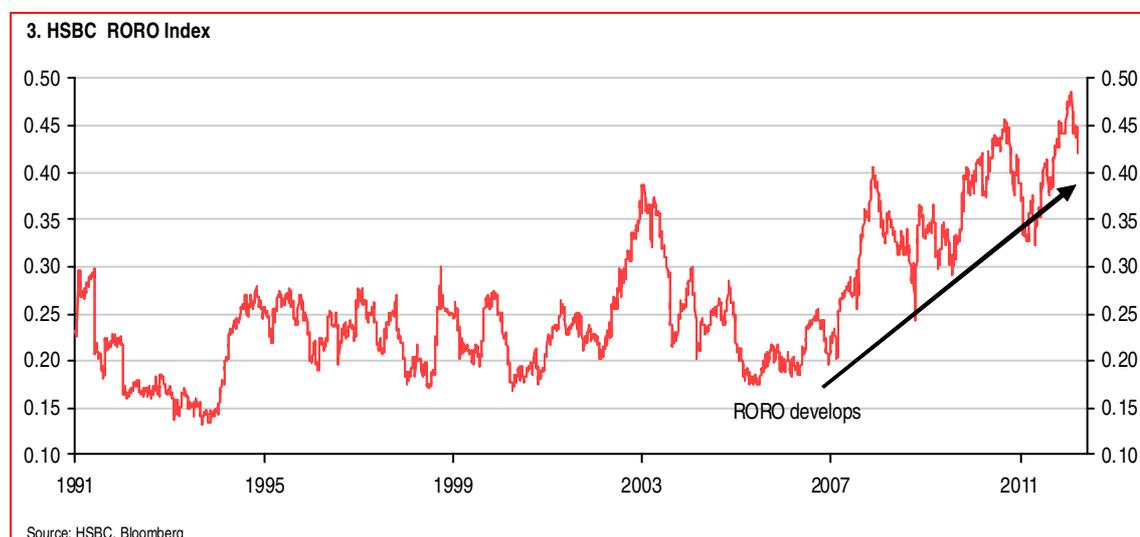
In stark contrast is an equivalent heatmap from April 2012 shown in chart 2. This heatmap is dominated by strong reds and blues and very few assets escape. The heatmaps are particularly good at showing how comprehensive the RORO effect is across the many different markets, and how correlations have become polarised as either strongly positive or strongly negative. Almost all assets are affected.

The evolution of the heatmaps through time can be seen in the HSBC video (<http://www.research.hsbc.com/midas/Res/RDV?p=pdf&ao=20&key=B0eCszKgbV&n=327442.HTM>).

The dramatic change in market structure, when Lehman collapses, is all too apparent.

## The RORO Index

The heatmaps are highly effective in depicting the change in market behavior, but an index is more precise and easier to track. The HSBC RORO Index has been created to measure the changing strength of the phenomenon and is shown in chart 3. It has been developed in collaboration with the University of Oxford Mathematical Institute and follows on from extensive joint work on market dynamics as described in a recently published Physical Review E paper (available at <http://arxiv.org/abs/1011.3225>) and PhD thesis (contact the authors for more information). Details of the methodology are described in appendix A, but in essence the index is very simple. The higher the index, the more RORO is dominating markets. *This index, together with the other HSBC RORO indices and heatmaps, are updated each week in the HSBC Currency Weekly publication (most recent version [here](#)).*



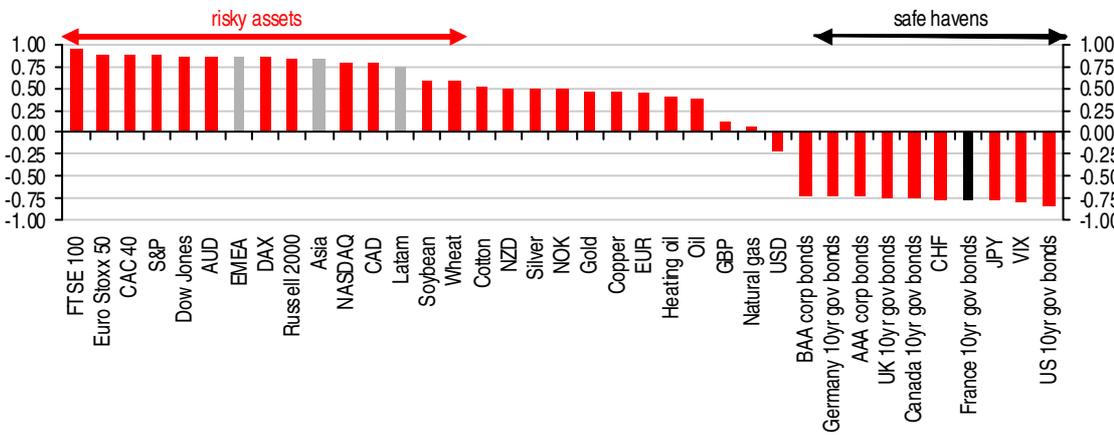
It is worth reiterating that the index measures the *strength* of RORO. A rising index does not indicate that the market is “risk on” – it indicates that the paradigm is gaining strength and correlations are rising. Markets could be moving in any direction, but they are highly synchronised.

Pre-Lehman the index was low and stable. The collapse of Lehman caused a dramatic rise in the index, and although choppy, the index has risen significantly in the subsequent years. All-time highs for the index were seen in December 2011 and, while it has fallen since then, it is still at very high levels. Risk on – Risk off continues to dominate today and the index has a long way to fall to hit pre-Lehman levels.

## Risk On – Risk Off and individual assets

While the RORO Index tracks the overall strength of the phenomenon, it is also useful to measure the extent to which particular assets are being influenced by RORO at any time. Some assets are more influenced than others and the degree of influence can change.

4. RORO profile 30 May 2011

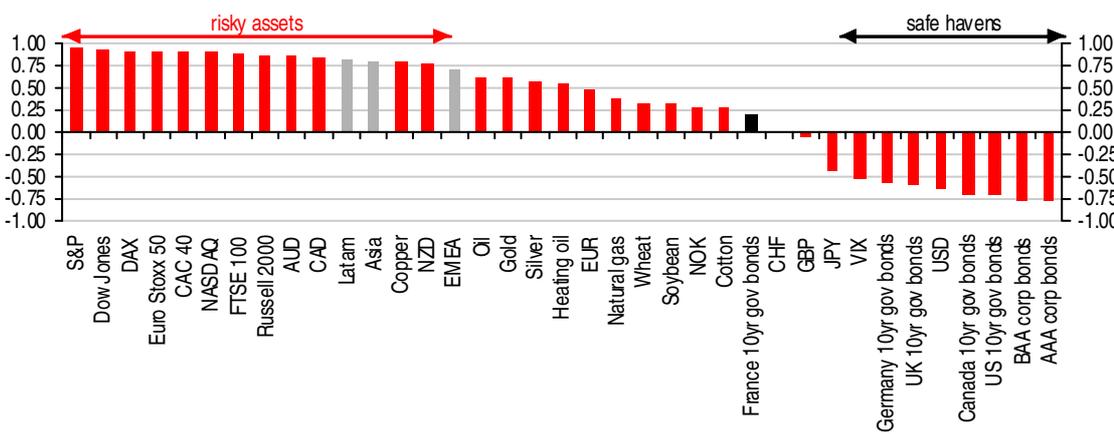


Source: HSBC, Bloomberg

### Profile charts

The influence on particular assets is shown in the profile chart for May 2011 (chart 4). The further to the left an asset is, the more it behaves as a “risk on” asset, such as equities. The further to the right the asset, the more it behaves as a safe-haven instrument such as US government bonds. A value close to zero on the bar chart indicates the asset is largely unaffected by RORO. The full methodology is explained in appendix A. In this period only natural gas and sterling were unaffected in this way.

5. RORO profile 16 March 2012

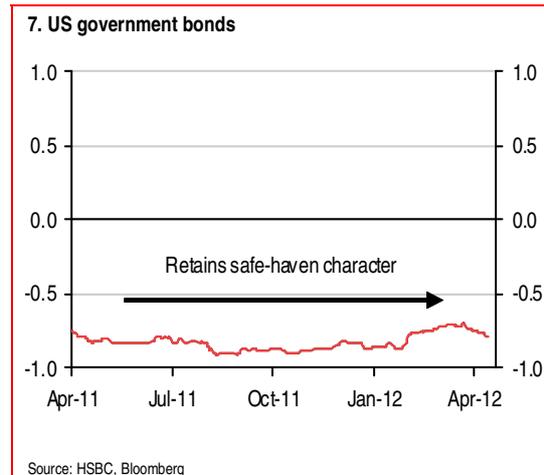
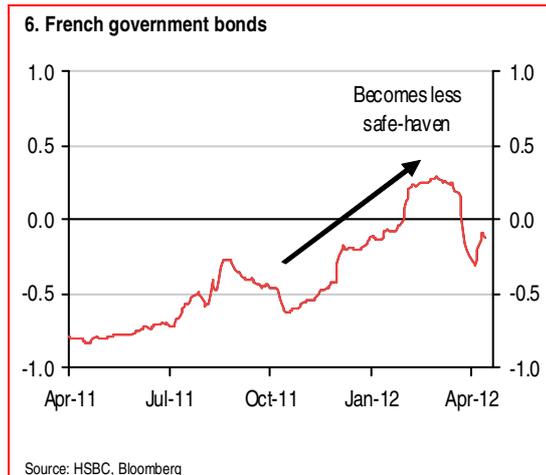


Source: HSBC, Bloomberg

Chart 5 shows the equivalent profile chart for March 2012 and, while the general picture is the same, some assets have moved position – most strikingly in this case, French government bonds. As we shall see, this is highly revealing about the changing forces that are at play for the asset in question.

## Tracking relationships through time

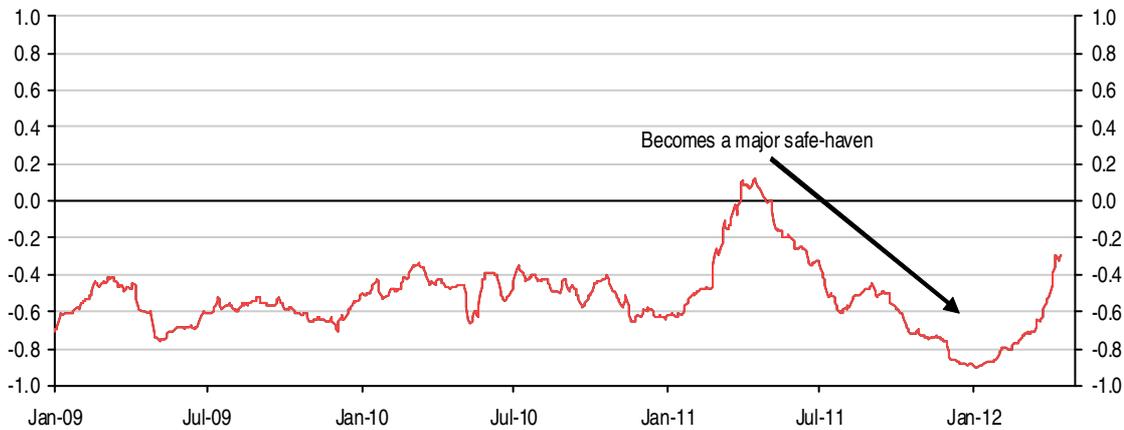
In fact the dominance of RORO on a given asset can be tracked systematically through time, giving deep insight into how the asset is trading and the extent to which RORO or its own fundamentals are responsible for the price action. This is of great importance to fund managers and asset allocators trying to make sense of what is really driving prices.



### Example 1 – French government bonds

Chart 6 shows the influence of RORO on French government bonds since April 2011. The equivalent chart for US government bonds is shown for comparison in chart 7. French bonds were initially trading as safe-haven instruments – showing a strong negative print on the chart. As the EUR crisis deepened, however, the change in behavior was stark. French government bonds rapidly de-coupled from other safe-haven instruments and over the final quarter of 2011 they drastically changed their behavior. Briefly, they even traded more like a risky asset as the credit premium started to dominate. US government bonds, in contrast, behave as solid safe-haven instruments throughout.

8. USD correlation with RORO factor



Source: HSBC, Bloomberg

## Example 2 – USD

The influence of RORO on the USD index is shown in chart 8. The USD behaved increasingly like a safe haven in the second half of 2011. This was precipitated by the Swiss National Bank putting a floor on EUR-CHF and through intervention by the Bank of Japan. Both the CHF and JPY lost their safe-haven status and the USD was the only suitable currency to fill the gap. Since the start of this year it has still been acting like a safe haven, although to a more typical degree.

9. Oil correlation with RORO factor



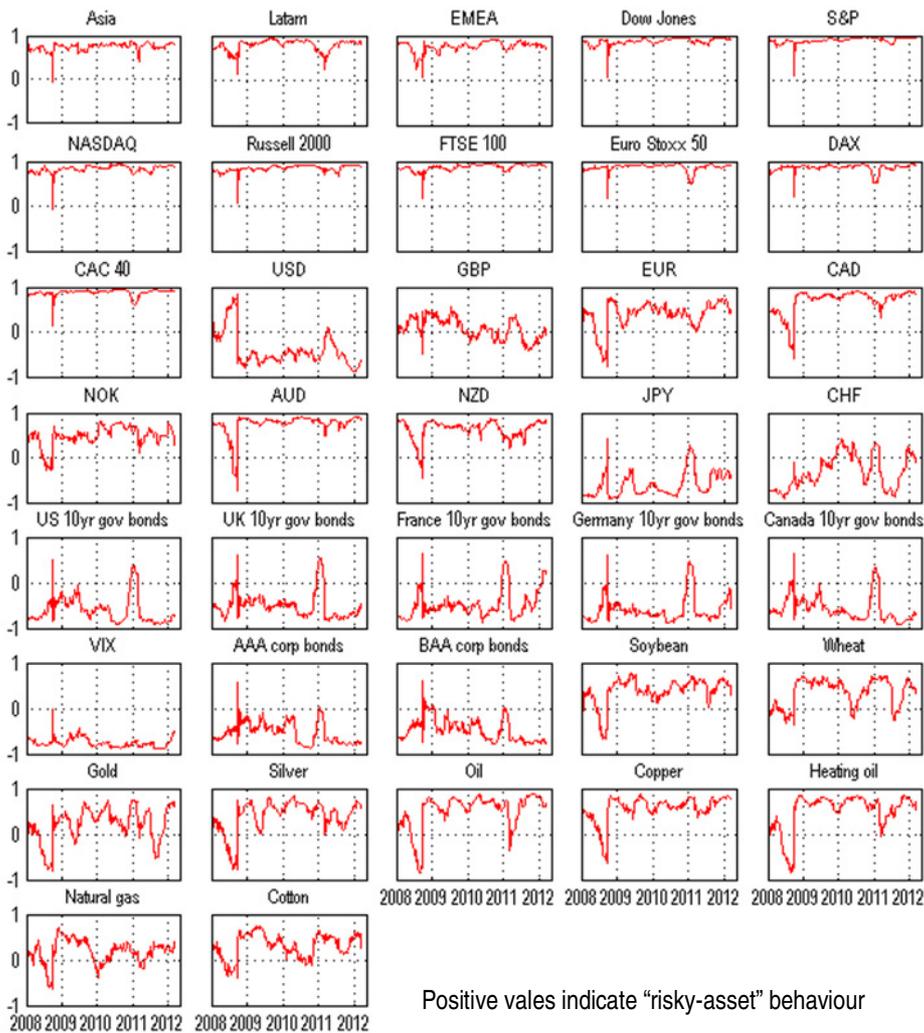
Source: HSBC, Bloomberg

## Example 3 – Oil

The behavior of oil is illustrated in chart 9. It has unsurprisingly traded like a risky asset for most of the last few years with the exception of early 2011. Here the Arab Spring temporarily dominated the price action, removing oil from the RORO paradigm. Soon enough, however, once the events of the Arab Spring passed, the behavior of oil reverted to type. Today, once again, the behavior of oil is starting to change as the Iran situation develops.

The behavior through time of the full range of assets we consider can be seen in chart 10.

10. Correlations with RORO factor



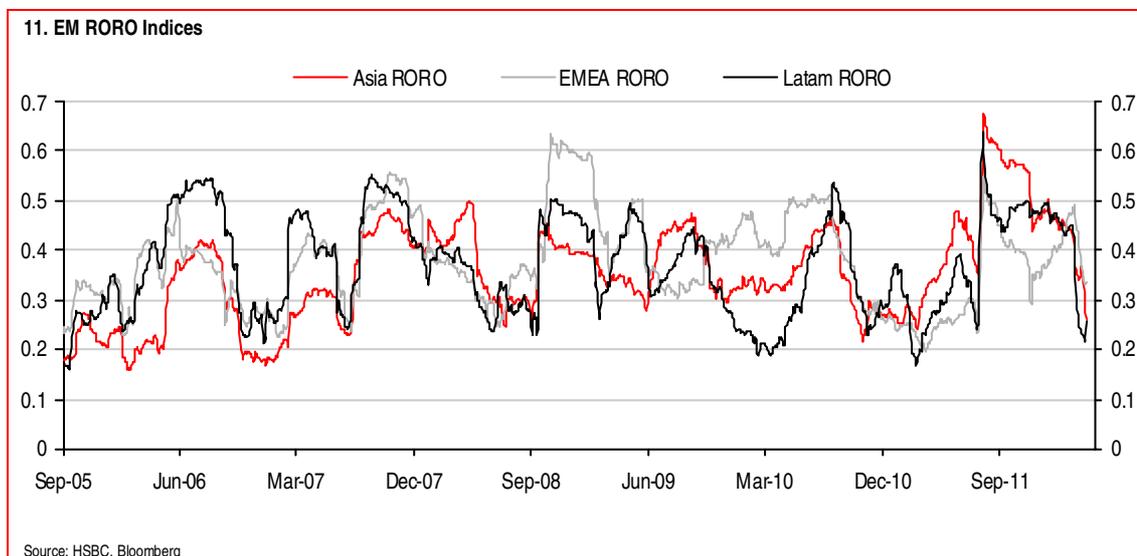
Source: HSBC, Bloomberg

## RORO and Emerging Markets

Emerging markets cannot escape RORO and we include them in our analysis. The situation is a little more complicated, however, as here we are interested in two distinct questions. Firstly, to what extent is an EM region internally correlated, e.g. do Latam markets move strongly together? Secondly, to what extent is a region dominated by the same RORO factor we considered for global assets?

Chart 11 shows the HSBC EM RORO indices. These indices track how strongly the three regions are internally correlated. The higher the index level for a region, the more the markets within it are moving together. The recent falls in the indices indicate that the variation of returns within the regions has recently improved.

The extent to which the EM regions are dominated by the RORO factor is shown in the profile charts in charts 4 & 5, which we looked at earlier. The light-grey bars depict the three regions and the full EM RORO methodology can be seen in appendix B. The three EM regions are strongly influenced by RORO and trade much like any other risky asset. As yet, there has been little divergence, but we can now track the EM regions and be alert to any decoupling from the general RORO paradigm.



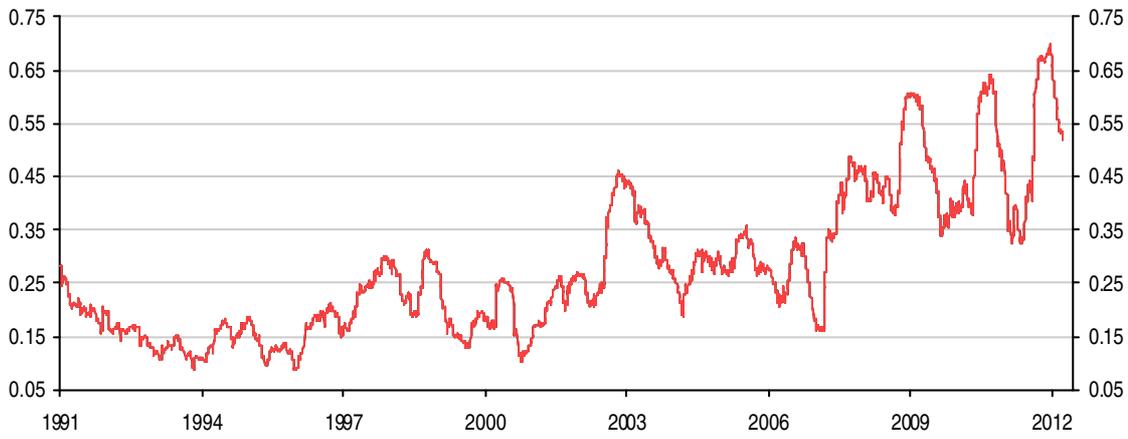
## Risk On – Risk Off and Equities

The quintessential “risk on” asset is equities and we have naturally included equities at index level in the RORO measures so far described. The equity markets themselves, however, are also of direct interest. The degree of correlation at the individual stock level has major consequences for equity managers and active managers in particular.

Chart 12 shows the HSBC Equity RORO index, based on stocks drawn from the S&P 500. The full methodology is described in appendix C. The higher the level of the index, the greater the degree of stock-level correlation, and the familiar pattern is clear. The Lehman collapse created a steep rise in correlation, and, although choppy, the index has generally been higher since.

Higher correlations mean less diversification between stocks, but the consequences for active equity managers are considerably more significant as we shall see in the next section.

12. Equity RORO Index



Source: HSBC, Bloomberg

# RORO & Investing

## RORO and the Investment Process

The consequences of RORO for asset managers and the investment process are profound. In a world where most asset classes are synchronised, it becomes very difficult to achieve diversification. It also means that since most individual assets are dominated by a common price component, it becomes increasingly futile to invest in them based on their usual fundamentals. Taking a long equity position or commodity position is essentially the same trade, as is being long CAD or being short bonds. Stock picking is harder in a RORO environment when prices move together so closely.

The problem is made worse by the fact that even many active strategies, such as FX carry and equity long/short, are also dominated by RORO. “Strategy space” as well as “asset space” is also affected, so active strategies which used to provide diversification through “alpha” no longer behave as normal. There are, however, ways of addressing this as we shall see shortly.

## Options for handling RORO

Here we suggest a number of strategies that could be employed in handling the RORO dominance in the market. Not all of these approaches will be suitable for or, even available to, all investors; but all are worthy of consideration.

- ▶ Trade the factor
- ▶ More imaginative diversification
- ▶ Seek unaffected active strategies
- ▶ Modify existing active strategies

### 1. Trade the factor

One approach is to accept the new market structure and not fight it. Rather than seek diversification one could focus on the only trade in town (i.e. whether to be long risk or short risk at any particular time). The trade could be expressed in any asset class based on mandate and liquidity. The skill here is to construct a portfolio that gives you the cleanest possible expression of the trade. The S&P alone would be a reasonable vehicle to express the trade, but a suitable basket of stock indices, say, would give better risk-adjusted return characteristics. The same is also true for commodities and currencies etc. We look at how to construct such portfolios in [‘Risk on – risk off: the full story’](#), November 2010. The investor still needs to get the call right of course, but it is a clean trade, and honest about new market conditions.

## 2. More imaginative diversification

When diversification is hard to find, look harder. The bar charts we showed earlier indicate the few assets that remain unaffected, such as natural gas. One can also widen the universe of investments that would normally be considered by looking at less liquid assets. One could invest in forests, agricultural land, ports, shopping malls, etc. Sovereign wealth funds and university endowment funds have been doing this for decades, as they have had the mandates and investment horizons to allow it. This approach will clearly not suit many investors, but is worthy of broader consideration.

## 3. Seek unaffected active strategies

Some active strategies, such as momentum, have remained largely impervious to Risk On – Risk Off. Markets trend and much of the active management space is focused on taking advantage of it in the most efficient risk-adjusted fashion. If markets moved as random walks, as implied by the efficient market hypothesis, then trend models would not work over time. The success of trend models (and in fact other price-driven models) is a manifestation of small but systematic mispricing, which disciplined momentum strategies can harvest. This rationale does not weaken in a RORO environment; there is no particular reason to suppose these anomalies would disappear in such markets. Trend models are particularly common in the FX markets and their construction and independence from RORO are covered in detail in the FX Quant Special [‘Momentum: Don’t stop me now’](#), 27 February 2012.

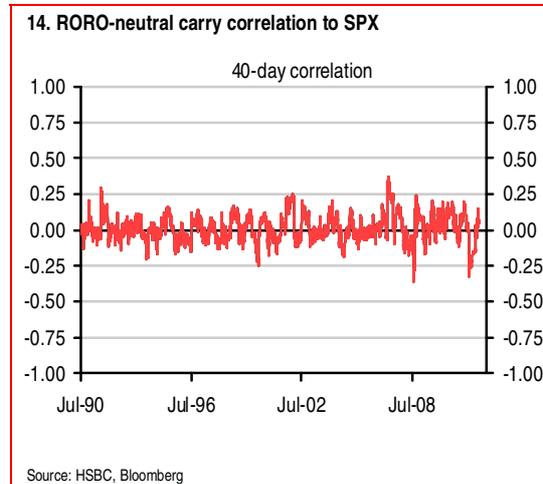
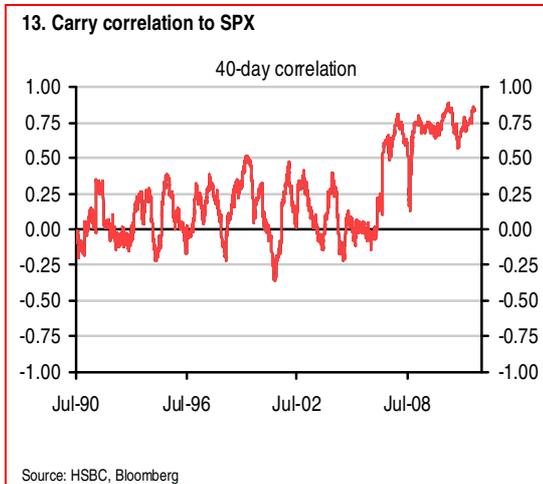
Higher frequency strategies have also tended to be less affected as they seek to capitalize on short-term market microstructure. Some volatility strategies may also fall into this category.

## 4. Modify existing active strategies

A more ambitious approach is to explicitly neutralize the effects of RORO. Many active strategies have become contaminated by a systemic risk factor. The approach here is to hedge that factor out. In the next section we look explicitly at how active strategies can be modified in this way.

## RORO and active strategies

It is reasonably intuitive that asset classes can become highly correlated in the presence of systemic risk; but it is less obvious why active strategies should also be affected. After all, the whole rationale behind active strategies is that they provide independent returns alongside passive investments in the underlying assets. The reasons why active strategies are also dominated are subtle but actually very clear.



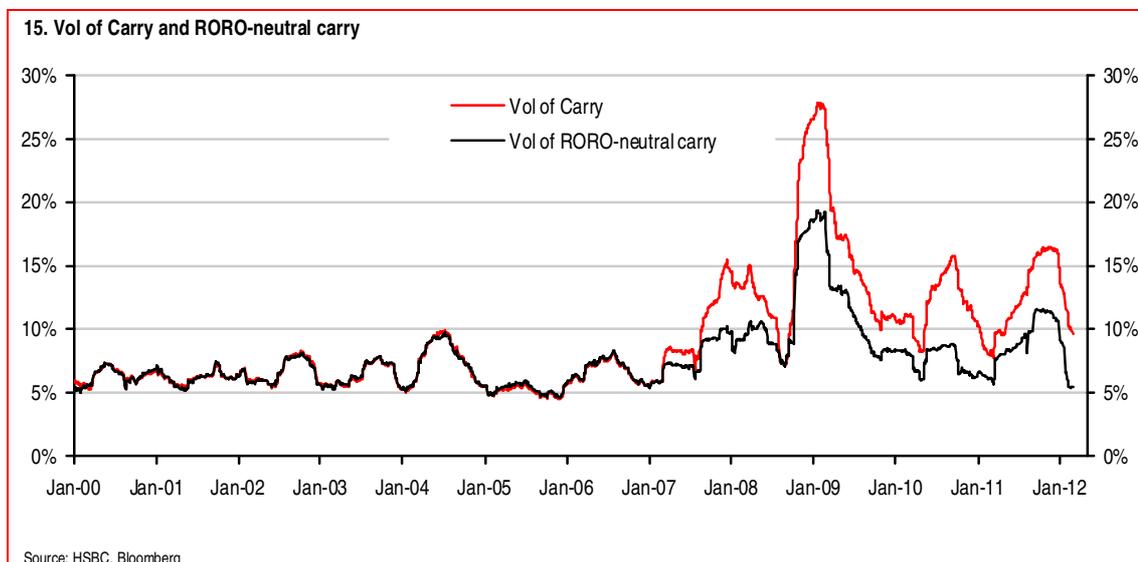
## RORO and FX Carry strategies

Carry strategies, which have been another major source of alpha in FX markets, are not so lucky. FX carry trades involve buying high-yielding currencies and selling low-yielding currencies to benefit from the interest rate differentials. The rationale for FX carry is the “forward rate bias”, which is underpinned by an extremely comprehensive literature. Carry trades have an expected positive return because, in principle, the investor is rewarded for holding the devaluation risk of higher-yielding currencies. The return is often referred to as a *carry beta*. It is comparable to the equity risk premium and historically independent from it (at least most of the time).

In today’s RORO environment that relationship has changed. Chart 13 shows the rolling correlation between returns from a traditional carry basket and returns from the S&P. Pre-crisis, the correlation fluctuates around zero. Post-Lehman the correlation leaps into positive territory and remains there. In short, the carry strategy has started to behave like any other risky asset. The carry beta has become contaminated by the same RORO factor that has overwhelmed every other asset class.

Holding a carry basket today is almost equivalent to holding a pre-crisis carry basket together with some S&P futures. This is a major problem in currency overlay where only uncorrelated returns are desired, but it is also a general problem. It is no longer a normal carry trade and can’t be managed as one.

An ambitious solution is to use S&P futures to hedge the factor out. One can, in effect, decontaminate the strategy from the influence of RORO through a dynamic portfolio. By tracking the size of the influence, an appropriate number of futures can be shorted in order to make the carry strategy RORO-neutral. This is demonstrated in chart 14.



The volatility through time of “simple” carry and “RORO-neutral” carry is shown in chart 15, with further details provided in appendix D. The RORO-neutral version is much more consistent and much closer to a “true” carry trade. It becomes an independent source of return again. It is not without its risks, and many mandates would not allow it. An approach such as this is necessary, however, if the genuine carry beta is to be accessed.

Of course, in being long FX carry one might want to explicitly keep the RORO risk. It might even outperform RORO-neutral carry. This becomes a straightforward “risk on” trade, however, and is really just an implementation of the “trade the factor” approach described above. It is not an FX carry trade in the traditional sense and does not provide useful independent returns versus other asset classes.

## RORO and Equity long/short strategies

Equity long/short strategies aim to trade the relative performance of equities at stock or sector level. The strategy might typically involve going long one sector and short another around some underlying benchmark portfolio, containing say the S&P 500. Low correlation to the underlying benchmark is an essential feature of the approach. Of course, in today’s world of high cross-asset correlations, equity market neutrality and RORO neutrality amount to the same thing.

The issue now faced by active equity managers is similar to that described for FX carry. The active returns are now also RORO dominated, although for a different, more subtle reason. Equities have always been correlated with each other as they contain a common market component. Relative-value trades would see these market components generally offset to give market neutrality.

The advent of RORO and higher equity correlations has dramatically changed this. Any failure to perfectly offset is now a problem as the common market components are, quite simply, bigger. When they don’t fully offset they leave a sizable market position left over, which dominates returns. These

supposed “alpha” returns are thus correlated to the underlying equity market and behave like any other risky asset. They change leverage rather than provide alpha.

This example has been more subtle and exemplifies how insidious the effects of RORO can be. Once again, however, there is hope. The solution to the problem is similar to that seen for FX carry. Equity long/short strategies can be constructed in a more sophisticated way so as to make them market-neutral and hence RORO-neutral. This can be done using S&P futures or by more judicious basket construction. Fuller details of the problem and various solutions can be found in [‘Equity Insights: Alpha – not dead, just hiding’](#), 6 December 2011.

## Relative-value strategies in general

The equity example above is really just a special case of relative-value strategies in general. Relative-value trades within commodities or between, say, equities and energy will all tend to suffer from the same problem. These strategies will typically result in unwanted RORO contamination which needs to be dealt with. The solutions are similar: active hedging to decontaminate the trade, or better portfolio construction.

In fact, even at the individual asset level this is true. A long USD-denominated oil position is really a relative-value trade between oil and the USD. Oil priced in AUD and CAD (at least at the moment) is much less RORO-dominated and more likely to respond more cleanly to oil-specific fundamentals.

## Conclusion

Risk On – Risk Off is a phenomenon of today’s markets which must be addressed. Its consequences run deep into the investment process and have major ramifications for many market participants, such as corporates and central banks. RORO is, however, a problem which can be monitored and tackled.

In this piece, we have set out how its influences can be countered through active management. In fact, the advent of Risk On – Risk Off presents a major opportunity. Those equipped to respond, with the techniques we have described, have a distinct advantage. They can access the returns that have become unavailable to many in the market.

# Appendix A: RORO Methodology

## Market-wide correlation index

### HSBC Risk On-Risk Off (RORO) Index

The Risk On-Risk Off (RORO) index is derived from the rolling correlations between the daily returns of the 34 assets listed in the table below. We construct the index by using principal component analysis (PCA) to decompose the 34 asset return time series into 34 principal components (PCs), which are mutually uncorrelated variables that explain the observed asset returns.

The return time series of the different assets can then be represented as linear combinations of the PCs. By construction, the first PC is the single component that explains the largest proportion of the variance in the asset returns; as such it can be considered to represent the most important factor driving financial markets. In current conditions, we interpret this component as a “risk on – risk off” factor.

When the first PC explains a large proportion of the variance in asset returns, this implies that market-wide correlations are strong, which is a key feature of the risk on-risk off phenomenon. The proportion of the variance in returns explained by the first PC thus provides an indication of the extent to which the risk on – risk off paradigm is driving markets.

We therefore define the RORO index as the proportion of the variance in market returns explained by the first PC. An increase in the RORO index implies an increase in market correlations, whereas a decrease implies that market correlations have fallen. In constructing the index, we focus on markets that have a large overlap in trading hours (Europe and North America and Asian currency markets). This enables us to track correlations on a daily basis without having to worry about the non-synchronicity of return time series.

We also consider correlations between the different assets and the risk on – risk off factor. These are the correlations between the individual asset return time series and the first PC. These correlations provide an indication of the extent to which risk on – risk off is driving different assets.

#### Assets included in the RORO Index

Equities	Government bonds (10 year)	Corporate bonds	Currencies ( trade weights indices)	Metals	Other
S&P	US	AAA	USD	Gold	VIX
Dow Jones	Canada	BAA	EUR	Silver	Oil
NASDAQ	UK		CHF	Copper	Natural Gas
Russell 2000	Germany		GBP		Heating Oil
FTSE 100	France		JPY		Wheat
Euro Stoxx 50			AUD		Soybean
DAX			CAD		Cotton
CAC 40			NZD		

Source: HSBC

# Appendix B: EM RORO

## Regional emerging market correlations

### HSBC Emerging Market RORO Indices

We produce Emerging Market RORO Indices for Asia, Latin America and EMEA. We construct the indices using a similar methodology to that described in Appendix A for the cross-asset RORO index. For each region, we use principal component analysis to decompose a representative set of return time series for that region into principal components (PCs). We then define each regional index as the proportion of the variance in that region's returns explained by the first principal component (PC).

For the original multi-asset RORO Index the first PC represents the most important global macro factor driving returns across many different markets. When this factor has a strong influence on markets, the RORO index is high. The regional EM indices have an analogous interpretation. For example, when the Asia RORO index is high this implies that a single factor is driving returns across Asia, which leads to strong correlations between Asian assets. Similarly, high levels of the Latam and EMEA RORO indices imply that correlations are high in Latin America and EMEA, respectively.

For each of the regions, we use both bond and equity data for the countries listed in the table below. To enable us to compare the regional indices, we use weekly price data to eliminate any effects due to the different time zones. This also allows us to compare these indices to the cross-asset RORO.

We calculate the correlation between the dominant market factor in the different regions and the main risk on – risk off factor that we identify in our cross-asset analysis. This is the correlations between the first PC for each region and the first PC for the cross-asset returns. The strength of these correlations provides an indication of the extent to which risk on – risk off is driving returns in each region.

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#### Assets included in the EM RORO Indices

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Asia	Latin America	EMEA
Hong Kong	Brazil	Czech Republic
South Korea	Mexico	Hungary
Singapore	Chile	Poland
India		South Africa
Taiwan		Turkey
Malaysia		
Thailand		

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Source: HSBC

# Appendix C: Equity RORO

## Equity market correlations

### HSBC Equity RORO Index

The HSBC Equity RORO Index looks at all current members of the S&P 500 Index that have an appropriate data history back to 1 January 1990. We use a similar construction methodology for this index to the one described in Appendix A for the RORO Index.

To construct the Equity RORO Index we perform a principal component analysis (PCA) on the returns of all of the equities that we consider. We define the index as the proportion of the variance in the returns of these equities that can be explained by the first principal component (PC).

This first PC is the most important factor driving the returns at any time. For the original multi-asset RORO Index the first PC represents the most important global macro factor driving returns across a wide range of different assets. When the RORO index is high, this factor is strong.

For the Equity RORO, there is an analogous interpretation; however, in this case we are only looking at the risky asset class of equities. When the Equity RORO index is high it indicates there is a “supercharged” market beta dominating stocks – correlations are high and individual identity is reduced.

We use the two indices together to characterise the stress in the global macro environment. High correlations are generally an indication of market strain and have consequences for most asset classes. The two indices help us to understand the extent to which stress is confined to risky assets or is more comprehensive.

# Appendix D: RORO-neutral carry

## Creating a beta-neutral carry strategy

### Removing RORO component from carry returns

Before we are able to discuss what we mean by RORO-neutral carry, we must first answer the question: what is the carry trade?

#### FX Carry

FX carry baskets involve going long currencies with high interest rates and going short currencies with low interest rates. However, despite this simple description, there are a multitude of different carry baskets that could be constructed. For example, choices need to be made on the following areas:

- ▶ Which currency universe do we consider?
- ▶ Which interest rate is being used to rank the currencies?
- ▶ At which frequency do we roll the FX positions?
- ▶ How frequently should we reconsider our long/short positions?
- ▶ How many currencies should we be long and how many should we be short?

Each of the decisions made above will have an influence on the returns one would get. However, the returns from different strategies will typically be highly correlated. As such, we consider just one representative carry basket for our simulations, which we refer to as the 3Hv3L strategy (see, for example, [‘Carry on – carry off’](#), Currency Weekly, 8 November 2010).

#### Carry vs RORO-neutral carry

For simplicity, in constructing RORO-neutral carry trade returns, we use the S&P 500 index as a proxy for the RORO factor. Each day we use a window of the past 40 trading days to calculate the beta of the 3Hv3L carry returns to the S&P. From this we calculate the necessary short-S&P position to become beta-neutral. The combination of long 3Hv3L and short S&P positions gives rise to out-of-sample returns from a beta-neutral carry strategy.

It is this beta-neutral strategy that we refer to as RORO-neutral carry. We find that the out-of-sample returns are indeed beta-neutral – which indicates that constructing a RORO-neutral carry strategy is technically feasible.

# Disclosure appendix

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